University of Manitoba | Environmental Health & Safety
Rm 191 Extended Education
406 University Crescent
Winnipeg MB R3T 2N2

April 29 2022

Re: Indoor Air Quality Testing at University of Mantioba Fort Garry and Bannatyne Campuses

Background

The University of Manitoba has undertaken Indoor Air Quality (IAQ) testing within a number of learning spaces across the Fort Garry and Bannatyne Campuses. Testing was completed in learning spaces scheduled for more than 15 hours per week and utilized by the largest number of students. Environmental Consultants from Pinchin Ltd. and UM Physical Plant, in collaboration with UM Environmental Health and Safety, attended site to perform the IAQ assessments. A 24-hour assessment was completed, and data from both occupied periods only as well as the full 24-hour cycle was assessed by Pinchin. The work conducted followed the guidance of the most recent Indoor Air Quality Standards for the indicators being assessed.

Results

Results from the 24hr testing period were within typical and acceptable ranges, indicating good air quality in the buildings for the duration of the testing period. Relative Humidity measurements were below the recommended comfort range; however, this is a common wintertime condition in Canada. The majority of temperatures were within the recommended occupant comfort range and are not indicative of a safety concern at these levels.

Fort Garry Campus - IAQ Testing 2022 Summary Table

Building	Room	Date of Testing	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	Temp. (degC)	Relative Humidity	Particulate Matter 2.5 (µg/m³)	Total Volatile Organic Compounds (ppb)
Active Living	GYM	9-Mar	523	0	21.3	8.90%	0.32	0.07
Allen	403	11-Mar	386	BDL	20.3	3.90%	2	BDL
Buller	312	8-Mar	480	BDL	22.2	10.70%	4	BDL
Drake	115	8-Mar	384	0	24.6	10.80%	1	BDL
EITC-E2	125	8-Mar	472	0.04	22.8	8.10%	1	235
EITC-E2	351	8-Mar	697	0	23.5	11.60%	3.1	BDL
EITC-E3	516	8-Mar	424.87	0.15	24.11	13.00%	0.21	BDL
Helen Glass - Initial Test	470	9-Mar	463	0	24	4.90%	1	604 - attributed to hand sanitizer in area. Retest recommended and completed on Mar 17.
Helen Glass - Secondary Test	470	17-Mar	481	0.01	24.2	18.20%	4	BDL
Isbister	136	9-Mar	409	0	22.4	3.53%	0.3	BDL
Parker	406	8-Mar	393	0	21	6.20%	0.54	BDL
Robson Hall	204	9-Mar	432	0.36	25.8	12.26%	0.21	BDL
Russell	211	11-Mar	411	BDL	20.7	6.90%	2	BDL

Bannatyne Campus - IAQ Testing 2022 Summary Table

Building	Room	Date of Testing 2022	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	Temp. (degC)	Relative Humidity	Particulate Matter 2.5 (µg/m³)	Total Volatile Organic Compounds (ppb)
Apotex	50	10-Mar	431	BDL	23	8.40%	0.13	BDL
Apotex	71	11-Mar	399	BDL	23.1	5.80%	0.01	BDL
BMSB	Theatre A	11-Mar	413	0	20.7	2.60%	0.03	BDL
BMSB	Theatre C	11-Mar	514	0	21.8	0.90%	1	BDL
BMSB	626	11-Mar	421	0	24.9	10.20%	1	BDL
BMSB	202-206	10-Mar	472	0.44	22.6	5.00%	0.03	51
Chown	A106	9-Mar	462	0.001	23.6	5.60%	0.04	BDL
Dentistry	D220	11-Mar	471	BDL	21	4.30%	1	BDL
Med Rehab	R224	12-Mar	387	0.01	23.6	3.70%	0.01	0.4
Med Rehab	R020	10-Mar	527	0	23.3	4.40%	3	BDL

BDL - Below Detection Limit of Monitoring Equipment

Next Steps

The Operations & Maintenance team will be reviewing humidity set-points in the ventilation systems and continuing to monitor performance. The Environmental Health & Safety Office (EHSO) is addressing further improvements to its Indoor Air Quality (IAQ) Program. The revised program will include an IAQ survey report including results from testing across campus facilities. This survey report will be conducted every 3 years to align with Workplace Safety and Health requirements for program review. If you have any questions on this testing or these results, please feel free to reach out directly.

Enclosed: Pinchin IAQ Results Reports - 2022

Thank you,

Delaine Russo
Director | Environmental Health & Safety
delaine.russo@umanitoba.ca

Rm 191 Extended Education
406 University Crescent
Winnipeg MB R3T 2N2

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FINAL

Investigation of Indoor Air Quality

Active Living Centre
430 University Crescent, Winnipeg Manitoba

Prepared for:

University of Manitoba
120 Physical Plant,
89 Freedman Crescent
Winnipeg, Manitoba, R3T 2N2

March 29, 2022

Pinchin File: 306866

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EXECUTIVE SUMMARY

Pinchin Ltd. (Pinchin) was retained by University of Manitoba (the Client) to conduct an investigation of indoor air quality (IAQ) that included 24-hour monitoring. The work was conducted at 430 University Crescent, Winnipeg Manitoba. Room 340 of the Active Living Centre was the data logging location chosen by the client as it was occupied by staff and students during the hours of 06:00-22:00. Room 340 is located on the 3rd and 4th floor of the Active Living Centre at the Fort Garry Campus. The client also requested that in locations where the 24-hour monitoring occurred, observations be made specifically to the cleanliness of supply air diffusers and return air grilles. As well an inspection of the Heating Ventilation Air Conditioning (HVAC) system was requested to determine if there were conditions present that could degrade air quality, i.e., dirty or wrongly fitted filters, presence of moisture, etc.

The majority of the indoor air quality measurements collected were within recommended ranges and meet the referenced criteria. Carbon dioxide concentrations suggested adequate ventilation. Carbon monoxide concentrations did not suggest the presence of exhaust or combustion gases. Temperature measurements were within the recommended comfort ranges for office environments. $PM_{2.5}$ concentrations were within typical ranges. Total Volatile Organic Compound (TVOC) concentrations were within the recommended range The Pinchin inspector did not identify any deficiencies with regards to unusual odours during the investigation.

Relative Humidity measurements were below the recommended comfort range which may result in dry skin, eye and nose irritation. However, it should be noted that low relative humidity is a common wintertime condition in Canada.

Pinchin inspected the Air Handling Units (AHUs) and concluded that the AHUs were in proper working order with no leaks or standing water build up. The filters in all the AHUs were clean and free of visible dust and debris.

Accumulated dust was observed around return air grates within the Gym.

The following recommendations are offered to improve air quality in this building:

1. Communicate the findings of this report to the staff, and health and safety representative.
2. Review the humidification system in the building to ensure it is operational and functioning properly. Consider making adjustments as necessary.
3. Clean soiling from return air grates. Review and improve where possible housekeeping in affected areas.

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1.0 INTRODUCTION AND SCOPE

1.1 Statement of Understanding

Pinchin Ltd. (Pinchin) was retained by University of Manitoba (the Client) to conduct an investigation of Indoor Air Quality (IAQ) that included 24-hour monitoring. The work was conducted at 430 University Crescent, Winnipeg Manitoba. Room 340 of the Active Living Centre was the data logging location chosen by the client as it was fully occupied by staff and students throughout the daytime hours. Room 340 is located on the 3rd and 4th floor of the Active Living Centre at the Fort Garry campus. The client also requested that in locations where the 24-hour monitoring occurred, observations be made specifically to the cleanliness of supply air diffusers and return air grilles. As well an inspection of the Heating Ventilation Air Conditioning (HVAC) system was requested.

1.2 Scope of Work

Pinchin performed the investigation from March 9 to March 10, 2022. The scope of this investigation was limited to room 340. As well as the HVAC system on the 100, 400, and 500 Floor Levels.

The investigation involved the following activities:

- Review site via in-person walkthrough for factors that could contribute to poor indoor air quality;
- Site review of HVAC system equipment servicing the entire building; and
- Data-logging of Carbon Dioxide (CO_2), Carbon Monoxide (CO), Temperature (Temp), Relative Humidity (RH), Total Volatile Organic Compounds (TVOCs) and Particulate Matter smaller than 2.5 micrometres ($PM_{2.5}$) within the Gym.

2.0 METHODOLOGY

2.1 Interviews and Site Reviews

Pinchin interviewed the University of Manitoba Physical Plant, Project and Building Managers to discuss the history of the building, maintenance practices and any indoor air quality concerns.

The investigator did not perform any destructive work to inspect concealed conditions inside wall and/or ceiling cavities.

2.2 Test Methods and Criteria

The following table presents the parameters measured in this investigation, the instruments and sampling/analytical methods used, the applicable units of measurement, and the Indoor Air Quality criteria used for the evaluation of the results.

Table I – IAQ Parameters Tested, Measurement Criteria and Instruments

Parameter	Unit of Measurement	Recommended Limit	Instrumentation
Carbon dioxide, CO_2	Parts per million in air (ppm)	Outdoor Air (ppm) + 700 ppm[1]	24 hour Data-log Monitoring using a 3M® EVM-7 Air Quality Monitor
Carbon monoxide, CO	ppm	5 ppm[2]	
Temperature, T	°C	21 to 25 °C, winter clothing[3]	
Relative Humidity, RH	%RH	25[4] to 65[5] %, for occupant comfort	
Total Volatile Organic Compounds, (TVOC)	Parts per billion (ppb)	400 ppb [6]	
Particulate Matter smaller than 2.5 micrometres, $PM_{2.5}$	µg/m³	25 µg/m³ [7], 24-hour mean	

All data-logging direct-reading instruments were calibrated before use.

3.0 FINDINGS

3.1 Results of Interviews

Project or Building Manager reported the following:

- Air Handling Units (AHU) filters are changed every three months or as needed.
- The occupant capacity within the Gym is approximately 250 people (peak times)

1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Ventilation for Acceptable Indoor Air Quality* [ANSI/ASHRAE Standard 62.1-2019]. Atlanta, GA: ASHRAE, 2019.
2 Health Canada: *Indoor Air Quality in Office Buildings: A Technical Guide*. Ottawa, ON: Health Canada, 1995.
3 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Thermal Environmental Conditions for Human Occupancy* [ANSI/ASHRAE Standard 55-2020]. Atlanta, GA: ASHRAE, 2020.
4 L.E. Burton, J.G. Girman, S.E. Womble: Airborne particulate matter within 100 randomly selected office buildings in the United States (BASE). Proceedings of Healthy Buildings 2000, Vol. 1 (2001).
5 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Thermal Environmental Conditions for Human Occupancy* [ANSI/ASHRAE Standard 55-2020]. Atlanta, GA:ASHRAE, 2020.
6 Value calculated from: US Environmental Protection Agency (EPA) "Building Assessment Survey and Evaluation (BASE) Study [Online] Available at http://www.epa.gov/iaq/base/summarized_data.html#Volatile_Organic_Compounds (Accessed August 25, 2014).
7 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Ventilation for Acceptable Indoor Air Quality* [ANSI/ASHRAE Standard 62.1-2019]. Atlanta, GA:ASHRAE, 2019.

3.2 Facility Description

Table II – Facility Description

Item	Details
Construction Date	2015
Number of Floors	Four floors above grade, one floor below grade
Structural Type	Steel
Foundation Type	Concrete
Exterior Cladding	Brick
HVAC	Forced Air
Roof	Built up
Flooring	Concrete.
Interior Walls	Drywall.
Ceilings	Steel Deck

3.3 Results of Site Reviews

Appendix I presents the drawings.

There are nine Air Handling Units within Active Living Centre. AHU-1 provides conditioned air to the strength and conditioning space of the building (Photo #1). Inside the AHU there were no leaks found or standing water (Photo #2), the filters fit properly and were observed to be clean (Photo #3). The condensate drain was free from any leaks or standing water (Photo #4).

AHU-2 provides conditioned air to Level 100, Agora of the building (Photo #5). Inside the AHU there were no leaks found or standing water (Photo #6), the filters fit properly and were observed to be clean (Photo #7). The condensate drain was free from any leaks or standing water (Photo #8).

AHU-3 provides conditioned air to the Multi Purpose Rooms on Level 200 of the building (Photo #9). Inside the AHU there were no leaks found or standing water, the filters fit properly and were observed to be clean (Photo #10). The condensate drain was free from any leaks or standing water (Photo #11).

AHU-4 provides conditioned air to the Offices on Level 200 of the building (Photo #12). Inside the AHU there were no leaks found or standing water, the filters fit properly and were observed to be clean (Photo #13). The condensate drain was free from any leaks or standing water (Photo #14).

AHU-5 provides conditioned air to the West Side on Level 300 of the building (Photo #15). Inside the AHU there were no leaks found or standing water (Photo #16), the filters fit properly and were observed to be clean (Photo #17). The condensate drain was free from any leaks or standing water (Photo #18).

AHU-6 provides conditioned air to the Atrium as well as the North Side on Level 300 and Level 400 of the building (Photo #19). Inside the AHU there were no leaks found or standing water (Photo #20), the filters fit properly and were observed to be clean (Photo #21). The condensate drain was free from any leaks or standing water (Photo #22).

AHU-7 provides conditioned air to the East Side on Level 300 and Level 400 of the building (Photo #23). Inside the AHU there were no leaks found or standing water (Photo #24), the filters fit properly and were observed to be clean (Photo #25). The condensate drain was free from any leaks or standing water (Photo #26).

AHU-8 provides conditioned air to the West Side on Level 400 of the building (Photo #27). Inside the AHU there were no leaks found or standing water (Photo #28), the filters fit properly and were observed to be clean (Photo #29). The condensate drain was free from any leaks or standing water (Photo #30).

AHU-9 provides conditioned air to the South Side on Level 400 of the building (Photo #31). Inside the AHU there were no leaks found or standing water (Photo #32), the filters fit properly and were observed to be clean (Photo #33). The condensate drain was free from any leaks or standing water (Photo #34).

In the 24-hour monitoring location there were observed to be 14 supply diffusers (Photo #35) and 20 return air grates (Photo #36). All supply diffusers are clean and free from obstructions. The return grates within the 24-hour monitoring area were observed to be dust covered.

The filters in the AHUs are Minimum Efficiency Reporting Value (MERV) of 8.

Refer to Appendix III for photographs from the investigation.

3.4 Results of Indoor Air Quality Tests

Appendix II presents the results of data-logging for IAQ parameters.

The EVM 7 air monitor was used for 24-hour data logging within Room 470, of $PM_{2.5}$, CO_2, CO, TVOC, Temperature, and Relative Humidity. The EVM-7 is a direct-reading and data logging instrument and was calibrated before use.

3.4.1 Carbon Dioxide (CO_2)

The 24-hour minimum CO_2 concentration recorded within the building was 389 ppm, the maximum CO_2 concentration was 874 ppm. The 24-hour average for CO_2 was 523 ppm. The average CO_2 concentration during **the occupied time** was 547 ppm. On March 9 and March 10 outdoor spot measurements were recorded. The average outdoor CO2 spot measurements for the two days was 427 ppm. The indoor carbon dioxide concentrations were below the limit of 1,127 ppm (427 ppm outdoors plus 700 ppm) recommended by American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) This indicates that the volume of the supply air was adequate for the occupancy loading at the time of the investigation.

3.4.2 Carbon Monoxide (CO)

The carbon monoxide concentrations were non-detectable or just at the detection limit of the instrumentation for the duration of the 24-hour datalogging. Health Canada advises that the detection of carbon monoxide above 5 ppm indicates a concern requiring further investigation.

3.4.3 Temperature (Temp)

The 24-hour minimum temperature measurement was 19.3 °C, the maximum temperature measurement was 22.2 °C. The 24-hour average temperature measurement was 21.3 °C. The average temperature measurement during **the occupied time** was 21.4 °C. On March 9 and March 10 outdoor spot measurements were taken each day. The average outdoor Temperature spot measurements for the two days was -19.5 °C for these dates. The indoor temperatures were within the recommended comfort ranges for office environments for typical dress during winter conditions, of 21 to 25 °C.

3.4.4 Relative Humidity (RH)

The 24-hour minimum Relative Humidity measurement was 5.3 %RH, the maximum measurement was 13.6 %RH. The 24-hour average measurement for relative humidity averaged 8.9 %RH. The average relative humidity measurement during **the occupied time** was 9.7 %RH. On March 9 and March 10 outdoor spot measurements were taken each day. The average outdoor Relative Humidity spot measurements for the two days was 64 %RH for these dates. Relative humidity below 25 %RH may result in complaints of dry skin and eye and nose irritation. Low relative humidity is a common winter time condition in Canada due to difficulties maintaining proper humidification.

3.4.5 Particulate Matter ($PM_{2.5}$)

The 24-hour minimum concentration for $PM_{2.5}$ was below the detection limit of the monitoring instrument, the maximum concentration for $PM_{2.5}$ was 10 µg/m³. The 24-hour average concentration for $PM_{2.5}$ averaged 0.32 µg/m³. The average $PM_{2.5}$ concentrations during **the occupied time** was 0.45 µg/m³. On March 9 and March 10 outdoor spot measurements were taken each day. The average outdoor $PM_{2.5}$ spot measurements for the two days was 26 µg/m³ for these dates. For reference, World Health Organization (WHO) provides a guideline of 25 µg/m³ over a 24-hour period. The indoor $PM_{2.5}$ concentrations in this building were within the recommended range.

3.4.6 Total Volatile Organic Compounds (TVOC)

The 24- hour minimum concentrations for TVOC was below the detection limits of the monitoring instrument, the maximum was 100 ppb. The 24-hour average for TVOCs was 0.07 ppb. The average TVOC concentrations during **the occupied time** was 0.11 ppb. On March 9 and March 10 outdoor spot measurements were taken and recorded as below the detection limit of the monitoring instrument. Based on US EPA research, office environments with TVOC concentrations up to 400 ppb would be at little risk of IAQ concern. As this is a guideline, complaints might be expected if concentrations were significantly above 400 ppb.

Table III – Summary of 24-Hour Data-logging IAQ based on Indoor Air Quality Criteria

Parameter	Measurement Average	Indoor Air Quality Measurement Criteria	Below Indoor Air Quality Measurement Criteria?
Carbon Dioxide	523 ppm	Outdoor Air (ppm) + 700 ppm	Yes
Carbon Monoxide	0 ppm	5ppm	Yes
Temperature (°C)	21.3 °C	21 to 25 °C, winter clothing	Yes
Relative Humidity (%)	8.9% RH	25 to 65 %, for occupant comfort	No
$PM_{2.5}$	0.32 µg/m³	25 µg/m³	Yes
TVOC	0.07 ppb	400 ppb	Yes

4.0 DISCUSSION

The majority of the indoor air quality measurements collected were within recommended ranges and meet the criteria of the guidelines referenced. Carbon dioxide concentrations suggested adequate ventilation. Carbon monoxide concentrations did not suggest the presence of exhaust or combustion gases. Temperature measurements were within the recommended comfort ranges for office environments. $PM_{2.5}$ concentrations were within typical ranges. Total Volatile Organic Compound (TVOC) concentrations were within the recommended range The Pinchin inspector did not identify any deficiencies with regards to unusual odours during the investigation.

Relative Humidity measurements were below the recommended comfort range which may result in dry skin, eye and nose irritation. However, it should be noted that low relative humidity is a common wintertime condition in Canada.

Pinchin inspected the Air Handling Units (AHUs) and indicated that the AHUs were in proper working order with no leaks or standing water build up. The filters in all the AHUs were clean and free of visible dust and debris.

Accumulated dust was observed around return air grates within room 340 area.

5.0 RECOMMENDATIONS

Pinchin offers the following recommendations to improve air quality in this building.

1. Communicate the findings of this report to the staff, and health and safety representative.
2. Review the humidification system in the building to ensure it is operational and functioning properly. Consider making adjustments as necessary.
3. Clean soiling from return air grates. Review and improve where possible housekeeping in affected areas.

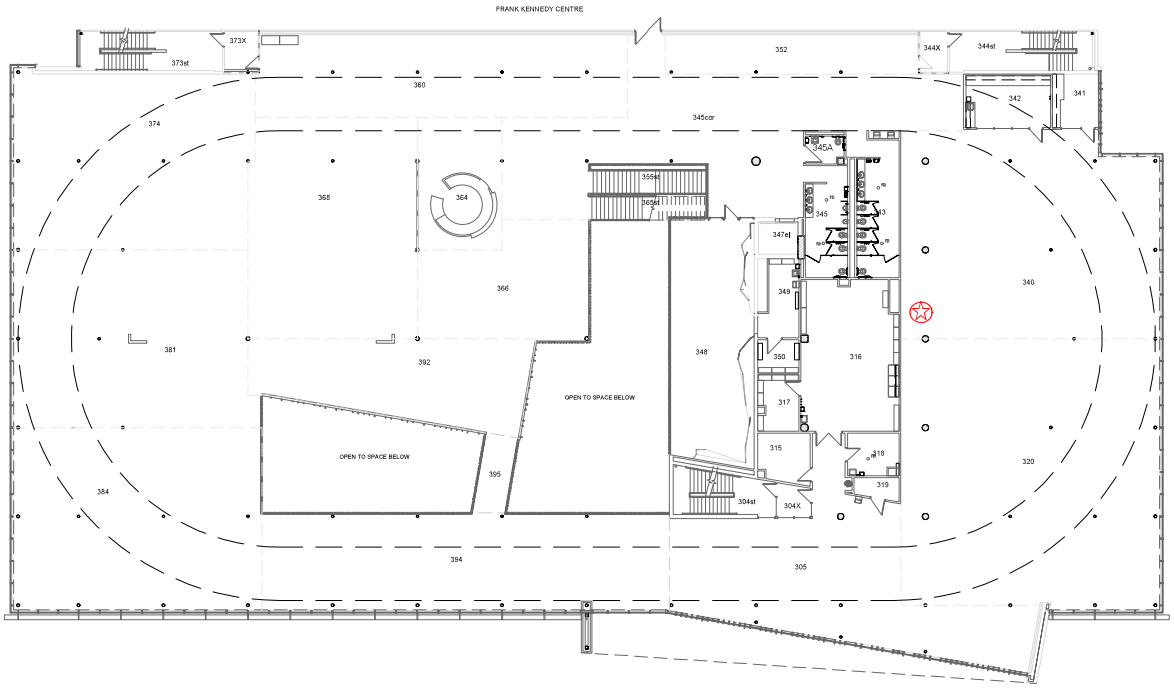
6.0 TERMS AND LIMITATIONS

This work was performed subject to the Terms and Limitations presented or referenced in the proposal for this project.

Information provided by Pinchin is intended for Client use only. Pinchin will not provide results or information to any party unless disclosure by Pinchin is required by law. Any use by a third party of reports or documents authored by Pinchin or any reliance by a third party on or decisions made by a third party based on the findings described in said documents, is the sole responsibility of such third parties. Pinchin accepts no responsibility for damages suffered by any third party as a result of decisions made or actions conducted. No other warranties are implied or expressed.

APPENDIX I

Drawing(s)



N

LEGEND

DATA LOGGING LOCATION

PINCHIN

PROJECT NAME:	Indoor Air Quality Assessment
CLIENT NAME:	University Of Manitoba
PROJECT LOCATION:	Active Living Centre 430 University Crescent Winnipeg, Manitoba
FIGURE NAME:	300 Level
PROJECT NUMBER: 306866	SCALE: NTS
DRAWN BY: BJA	REVIEWED BY: JB
DATE: March 2022	FIGURE NUMBER: 1 OF 1

APPENDIX II

Results of Data-Logging Indoor Air Quality Measurements

Session Report
430 University Crescent
Active Living Center

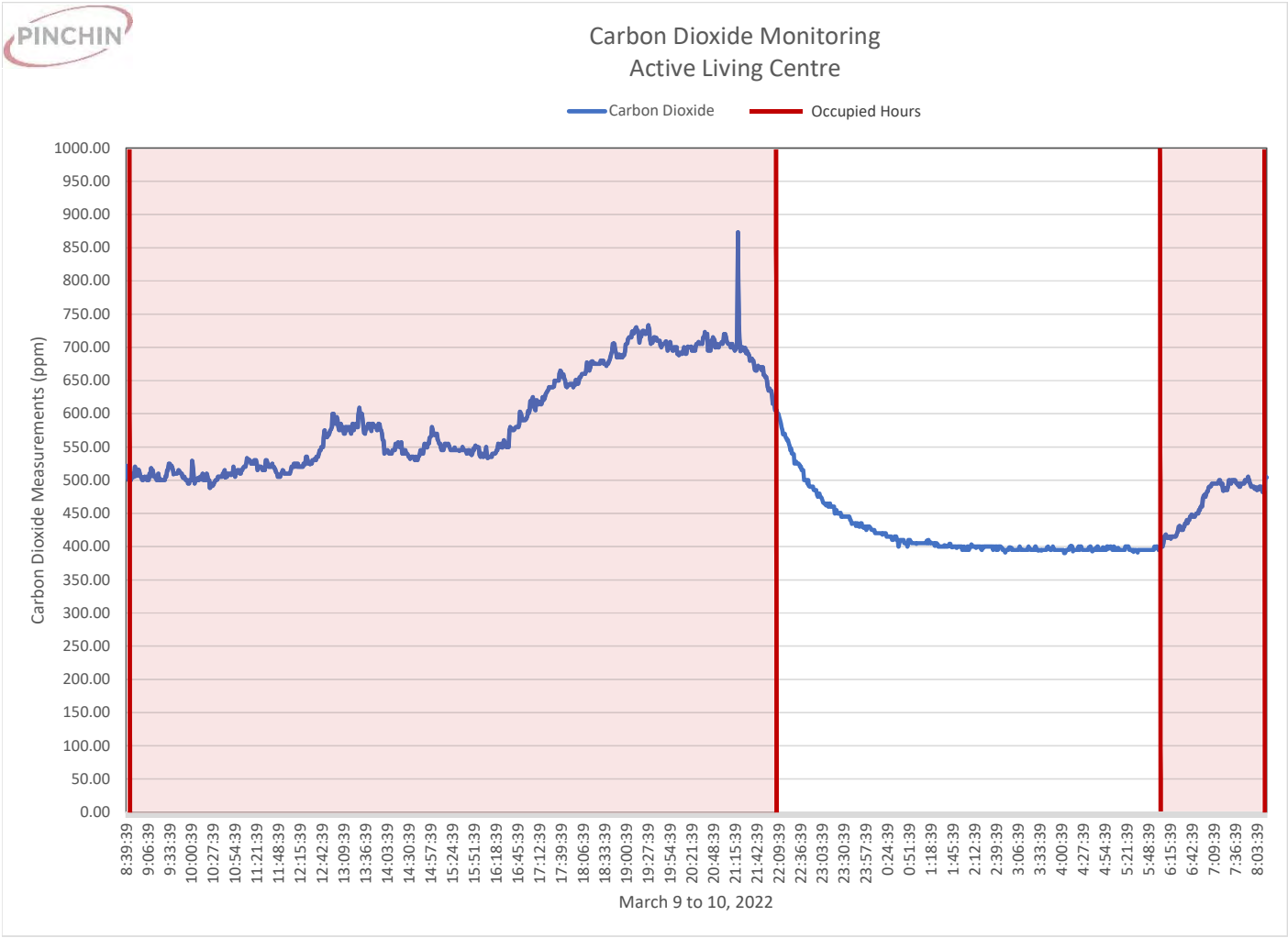
3/9/2022

Datalog Period

Device Name	EMI050016
Serial Number	EMI050016
Run Time	23:34:56
Start Time	3/9/2022 8:38:39 AM
Stop Time	3/10/2022 8:13:35 AM

IAQ Data Summary

Description	Value	Description	Value
CO2Ave	523 PPM	CO2Max	874 PPM
CO2MaxTime	3/9/2022 9:18:52 PM	CO2Min	389 PPM
COAve	0 PPM	COMax	0 PPM
COMin	0 PPM	Dust Average	0.320 ug/m³
Dust Max	10.000 ug/m³	Dust Min	0.000 ug/m³
Humidity Avg	8.9 %	Humidity Max	13.6 %
Humidity Max Time	3/9/2022 7:40:51 PM	Humidity Min	5.3 %
Humidity Min Time	3/10/2022 5:43:50 AM	PIDAvePPB	0.07 PPB
PIDMaxPPB	100 PPB	PIDMinPPB	Below the Detection Limit of the Monitoring Instrument
Temp Avg	21.3 °C	Temp Max Time	3/9/2022 4:34:13 PM
Temp Min Time	3/9/2022 8:38:39 AM	Temperature Max	22.2 °C
Temperature Min	19.3 °C		
Dust Impactor Setting	2.5 µm		


PINCHIN
Carbon Dioxide Monitoring
Active Living Centre
Carbon Dioxide
Occupied Hours
Carbon Dioxide Measurements (ppm)
1000.00
950.00
900.00
850.00
800.00
750.00
700.00
650.00
600.00
550.00
500.00
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
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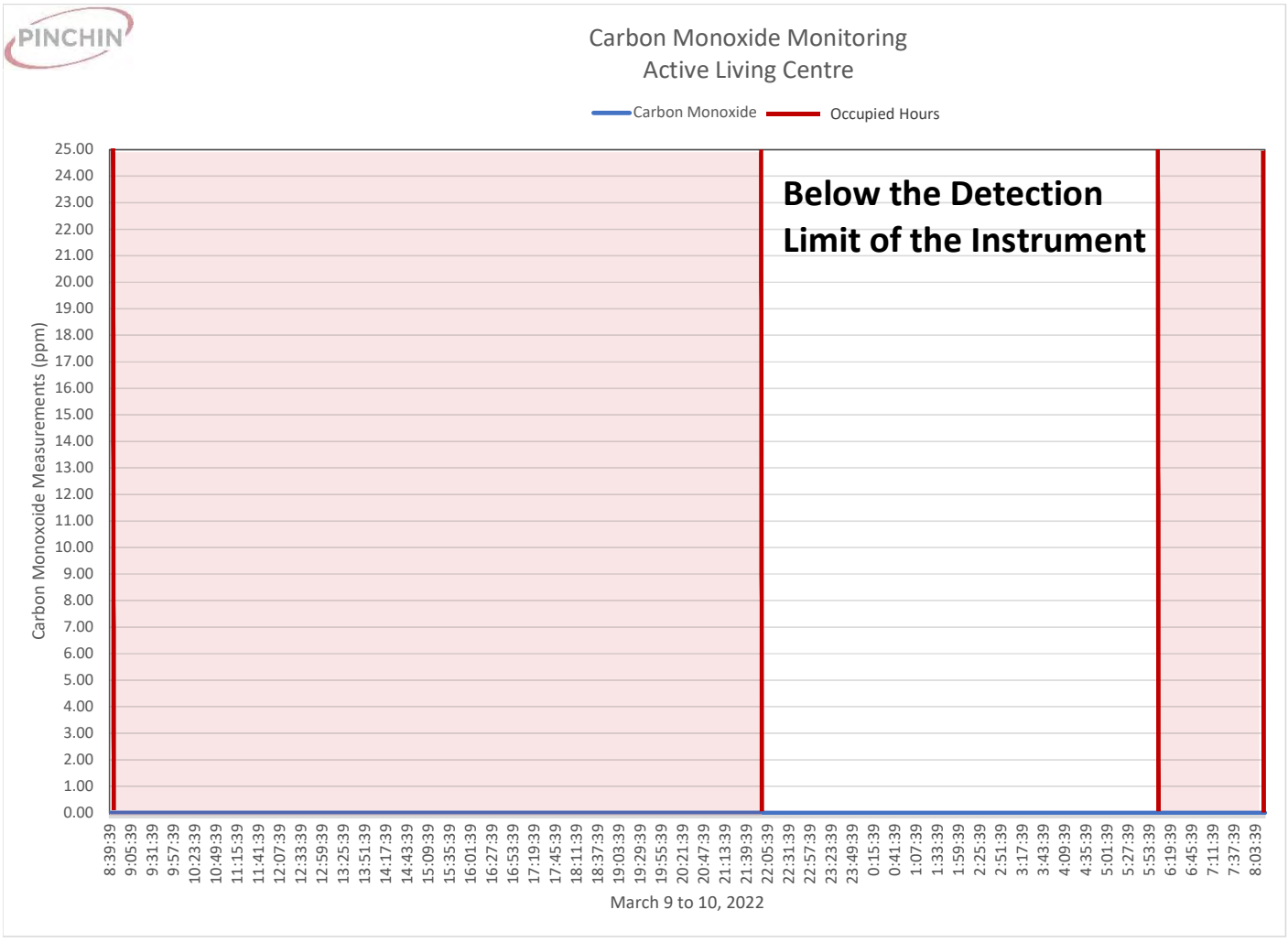
March 9 to 10, 2022


PINCHIN
Carbon Monoxide Monitoring
Active Living Centre
Carbon Monoxide
Occupied Hours
Below the Detection Limit of the Instrument
Carbon Monoxoide Measurements (ppm)
25.00
24.00
23.00
22.00
21.00
20.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
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22:31:39
22:57:39
23:23:39
23:49:39
0:15:39
0:41:39
1:07:39
1:33:39
1:59:39
2:25:39
2:51:39
3:17:39
3:43:39
4:09:39
4:35:39
5:01:39
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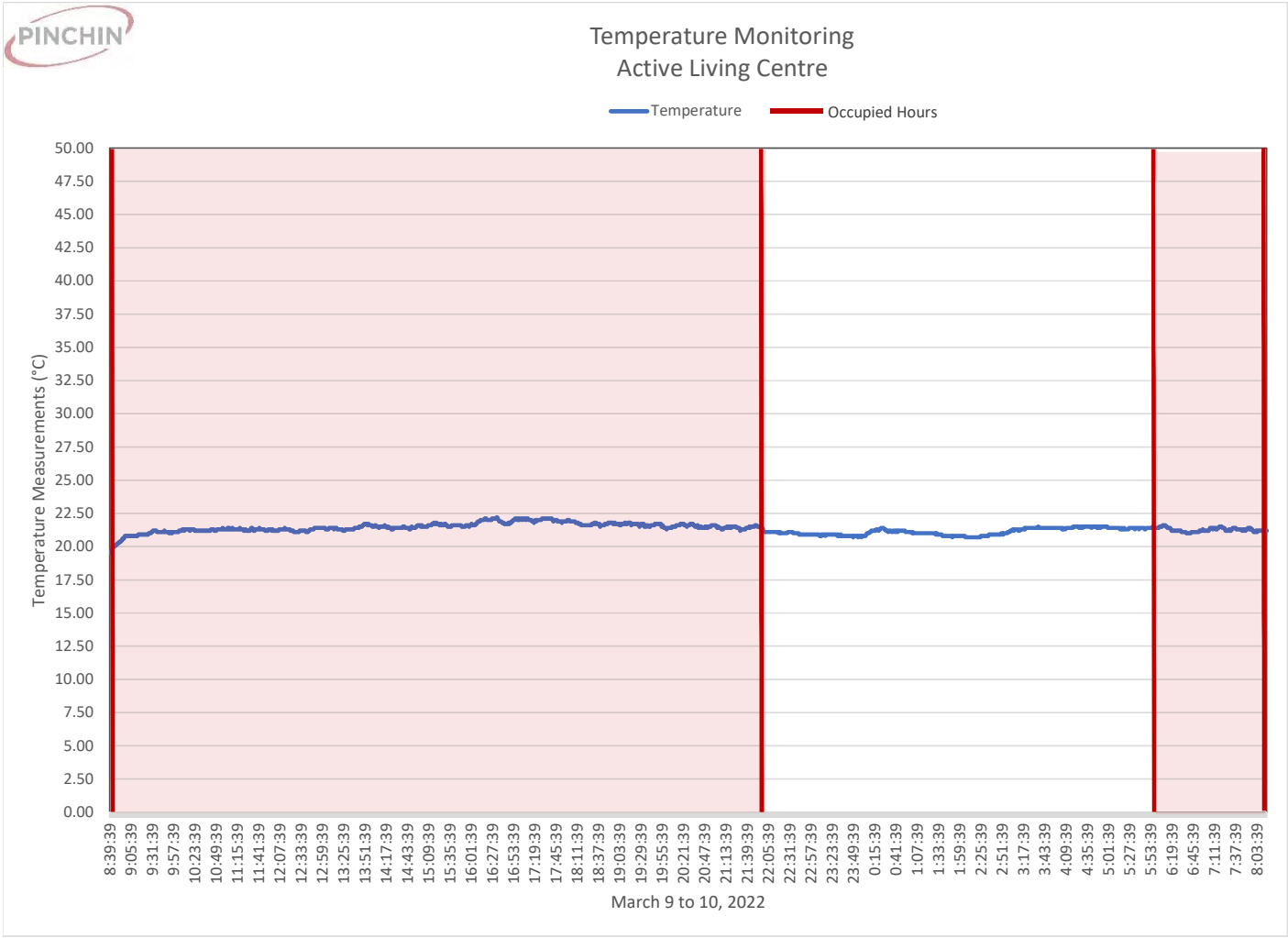
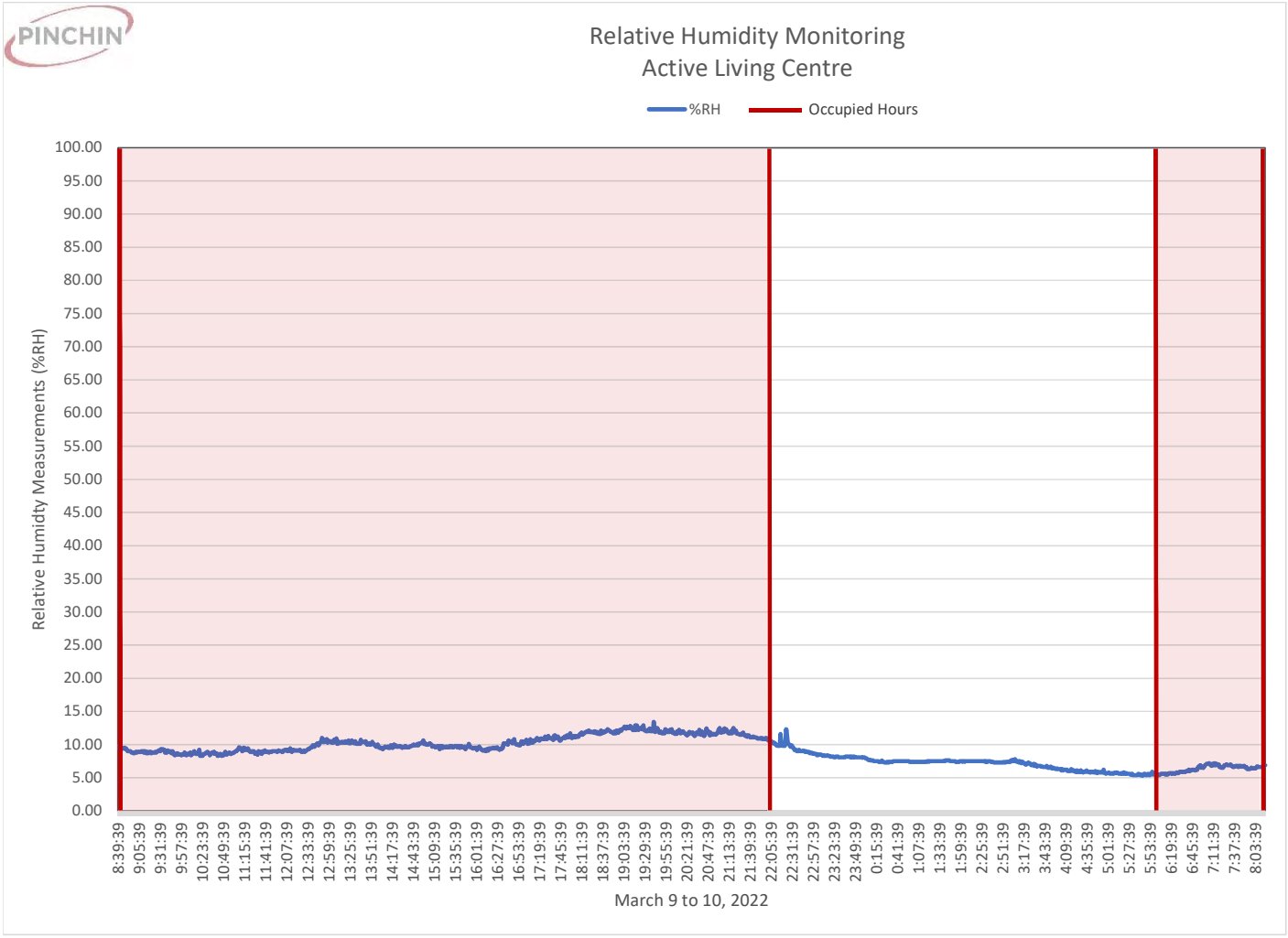
6:45:39
7:11:39
7:37:39
8:03:39
March 9 to 10, 2022


PINCHIN
Temperature Monitoring
Active Living Centre
Temperature
Occupied Hours
Temperature Measurements (°C)
50.00
47.50
45.00
42.50
40.00
37.50
35.00
32.50
30.00
27.50
25.00
22.50
20.00
17.50
15.00
12.50
10.00
7.50
5.00
2.50
0.00
8:39:39
9:05:39
9:31:39
9:57:39
10:23:39
10:49:39
11:15:39
11:41:39
12:07:39
12:33:39
12:59:39
13:25:39
13:51:39
14:17:39
14:43:39
15:09:39
15:35:39
16:01:39
16:27:39
16:53:39
17:19:39
17:45:39
18:11:39
18:37:39
19:03:39
19:29:39
19:55:39
20:21:39
20:47:39
21:13:39
21:39:39
22:05:39
22:31:39
22:57:39
23:23:39
23:49:39
0:15:39
0:41:39
1:07:39
1:33:39
1:59:39
2:25:39
2:51:39
3:17:39
3:43:39
4:09:39
4:35:39
5:01:39
5:27:39
5:53:39
6:19:39
6:45:39
7:11:39
7:37:39
8:03:39
March 9 to 10, 2022


PINCHIN
Relative Humidity Monitoring
Active Living Centre
%RH
Occupied Hours
Relative Humidty Measurements (%RH)
100.00
95.00
90.00
85.00
80.00
75.00
70.00
65.00
60.00
55.00
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
8:39:39
9:05:39
9:31:39
9:57:39
10:23:39
10:49:39
11:15:39
11:41:39
12:07:39
12:33:39
12:59:39
13:25:39
13:51:39
14:17:39
14:43:39
15:09:39
15:35:39
16:01:39
16:27:39
16:53:39
17:19:39
17:45:39
18:11:39
18:37:39
19:03:39
19:29:39
19:55:39
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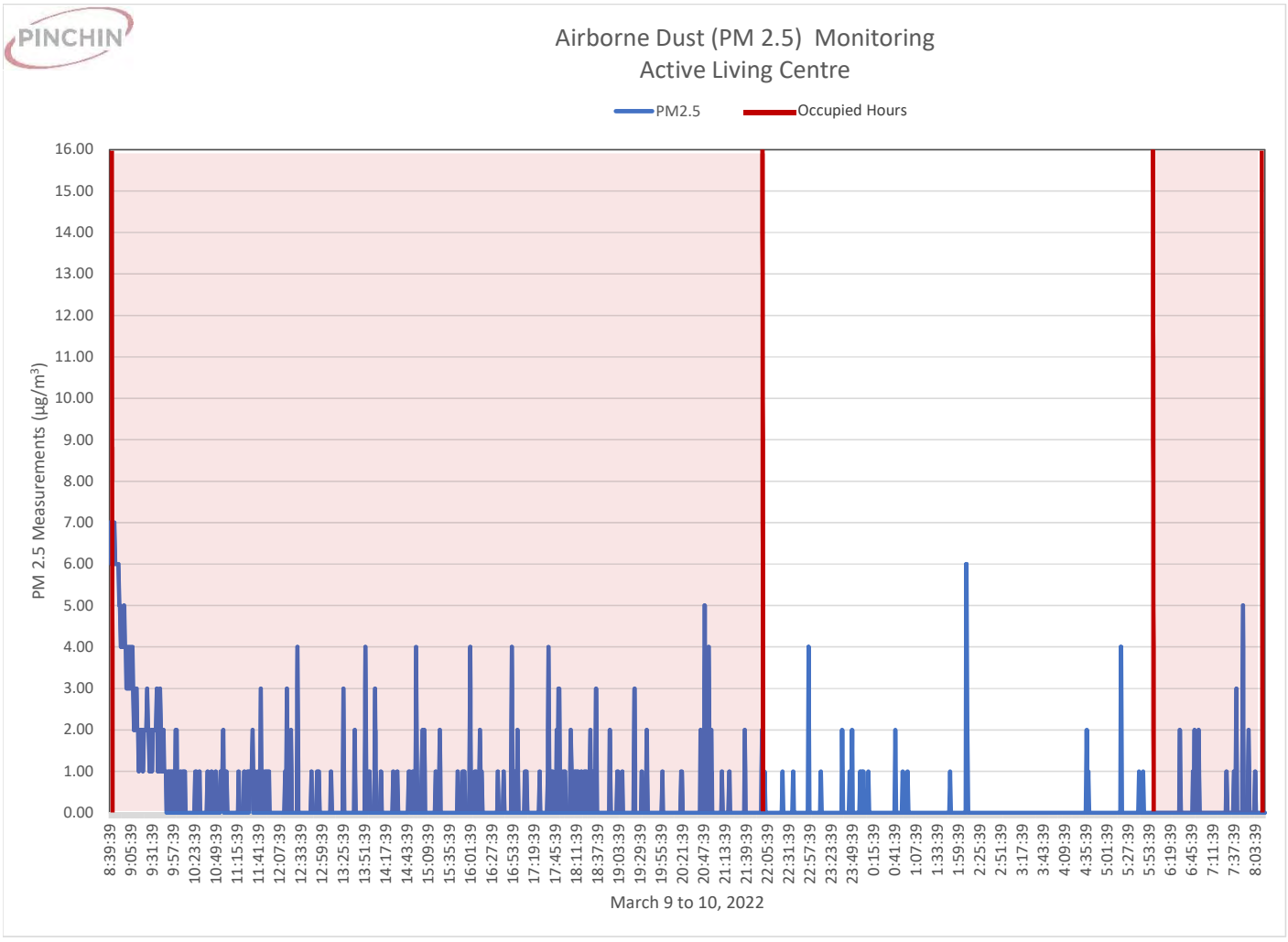
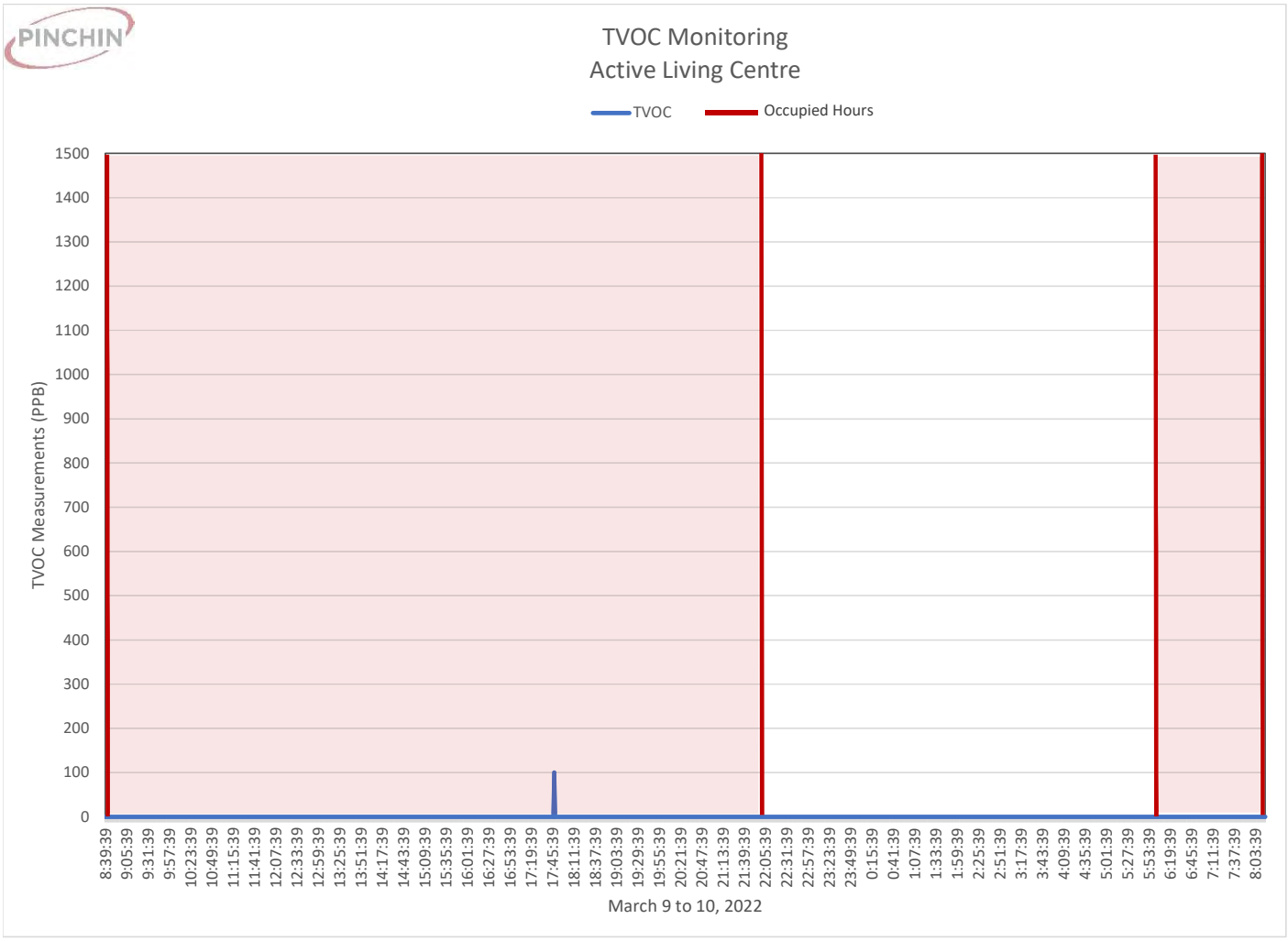
20:47:39
21:13:39
21:39:39
22:05:39
22:31:39
22:57:39
23:23:39
23:49:39
0:15:39
0:41:39
1:07:39
1:33:39
1:59:39
2:25:39
2:51:39
3:17:39
3:43:39
4:09:39
4:35:39
5:01:39
5:27:39
5:53:39
6:19:39
6:45:39
7:11:39
7:37:39
8:03:39
March 9 to 10, 2022


PINCHIN
Airborne Dust (PM 2.5) Monitoring
Active Living Centre
PM2.5
Occupied Hours
PM 2.5 Measurements (µg/m³)
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
8:39:39
9:05:39
9:31:39
9:57:39
10:23:39
10:49:39
11:15:39
11:41:39
12:07:39
12:33:39
12:59:39
13:25:39
13:51:39
14:17:39
14:43:39
15:09:39
15:35:39
16:01:39
16:27:39
16:53:39
17:19:39
17:45:39
18:11:39
18:37:39
19:03:39
19:29:39
19:55:39
20:21:39
20:47:39
21:13:39
21:39:39
22:05:39
22:31:39
22:57:39
23:23:39
23:49:39
0:15:39
0:41:39
1:07:39
1:33:39
1:59:39
2:25:39
2:51:39
3:17:39
3:43:39
4:09:39
4:35:39
5:01:39
5:27:39
5:53:39
6:19:39
6:45:39
7:11:39
7:37:39
8:03:39
March 9 to 10, 2022


PINCHIN
TVOC Monitoring
Active Living Centre
TVOC
Occupied Hours
TVOC Measurements (PPB)
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
8:39:39
9:05:39
9:31:39
9:57:39
10:23:39
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5:01:39
5:27:39
5:53:39
6:19:39
6:45:39
7:11:39
7:37:39
8:03:39
March 9 to 10, 2022

APPENDIX III

Photos

Photo 1 - AHU-1

Photo 2 - Inside AHU-1 free from leaks and standing water

Photo 3 - AHU-1 filters (clean)

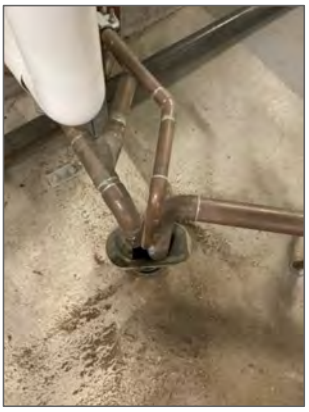

Photo 4 - AHU-1 condensate drain free from leaks and standing water

Photo 5 - AHU-2

Photo 6 - Inside AHU 2 free from leaks and standing water

Photo 7 - AHU-2 filters (clean)

Photo 8 - AHU-2 condensate drain free from leaks and standing water

Photo 9 - AHU-3

Photo 10 - AHU-3 filters (clean)

Photo 11 - AHU-3 condensate drain free from leaks and standing water

Photo 12 - AHU-4

Photo 13 - AHU-4 filters (clean)

Photo 14 - AHU-4 condensate drain free from leaks and standing water

Photo 15 - AHU-5

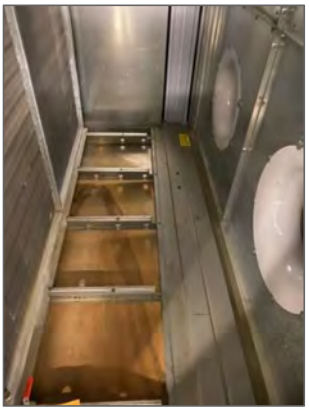

Photo 16 - Inside AHU-5 free from leaks and standing water

Photo 17 - AHU-5 filters (clean)

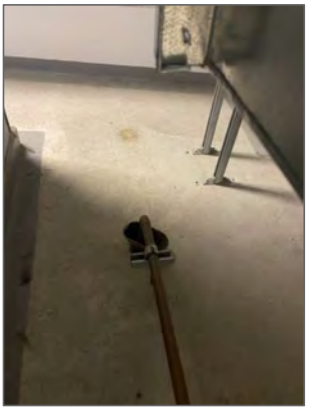

Photo 18 - AHU-5 condensate drain free from leaks and standing water

Photo 19 - AHU-6

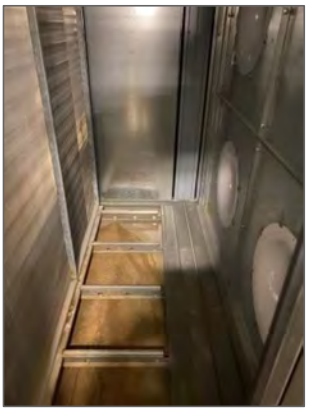

Photo 20 - Inside AHU-6 free from leaks and standing water

Photo 21 - AHU-6 filters (clean)

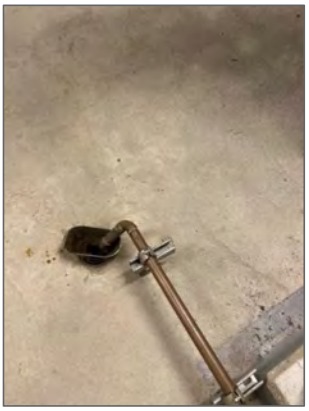

Photo 22 - AHU-6 condensate drain free from leaks and standing water

Photo 23 - AHU-7

Photo 24 - Inside AHU-7 free from leaks and standing water

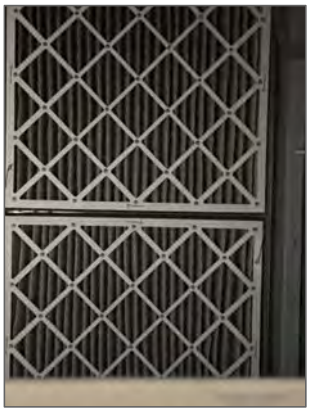

Photo 25 - AHU-7 filters (clean)

Photo 26 - AHU-7 condensate drain free from leaks and standing water

Photo 27 - AHU-8

Photo 28 - Inside AHU-8 free from leaks and standing water

Photo 29 - AHU-8 filters (clean)

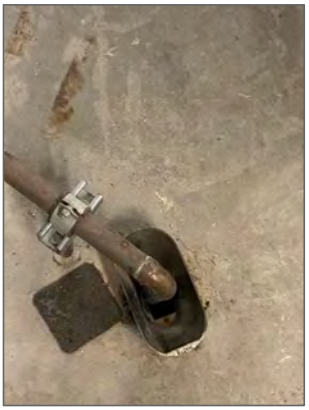

Photo 30 - AHU-8 condensate drain free from leaks and standing water

Photo 31 - AHU-9

Photo 32 - Inside AHU-9 free from leaks and standing water

Photo 33 - AHU-9 filters (clean)

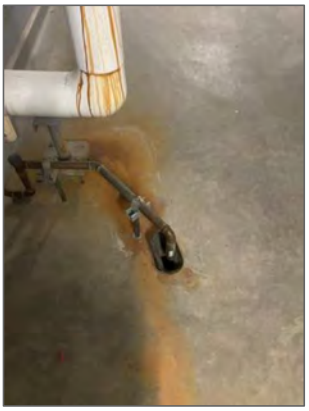

Photo 34 - AHU-9 condensate drain free from leaks and standing water

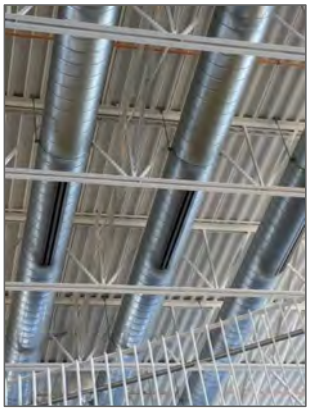

Photo 35 - Gym supply diffuser

Photo 36 - Gym return grate (dirty)

FINAL

Investigation of Indoor Air Quality

Allen Building
30A Sifton Road, Winnipeg, Manitoba

Prepared for:

University of Manitoba
120 Physical Plant, 89 Freedman Crescent
Winnipeg, Manitoba, R3T 2N2

April 14, 2022

Pinchin File: 306866

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EXECUTIVE SUMMARY

Pinchin Ltd. (Pinchin) was retained by University of Manitoba (the Client) to conduct an investigation of indoor air quality (IAQ) that included 24-hour monitoring. The work was conducted at 30A Sifton Road, Winnipeg, Manitoba. Room 403 of the Allen Building was the data logging location chosen by the client as it was occupied by staff and students during the hours of 08:30 – 11:30, and 14:30 – 17:30. Room 403 is located on the 4th floor of the Allen Building at the Fort Garry campus. The client also requested that in this location, observations be made specifically to the cleanliness of supply air diffusers and return air grilles.

Along with the 24 hour monitoring in Room 403 the client requested an inspection of the Heating Ventilation Air Conditioning (HVAC) system to determine if there were conditions present that could degrade air quality, i.e., dirty or wrongly fitted filters, presence of moisture, etc..

The majority of the indoor air quality measurements collected were within recommended ranges and meet the criteria of the guidelines referenced. Carbon dioxide concentrations suggested adequate ventilation. Carbon monoxide concentrations did not suggest the presence of exhaust or combustion gases. Temperature measurements were within the recommended comfort ranges for office environments. $PM_{2.5}$ concentrations were within typical ranges. Total Volatile Organic Compound (TVOC) concentrations were within the recommended range. As well the Pinchin inspector did not identify any deficiencies with regards to unusual odours during the investigation.

Relative Humidity measurements were below the recommended comfort range which may result in dry skin, eye and nose irritation. However, it should be noted that low relative humidity is a common wintertime condition in Canada.

Temperature measurements were below the recommended comfort range for commercial environments within Room 403. Temperature preferences are, however, very personal and these conditions might be acceptable to the occupants.

Pinchin inspected the Air Handling Units (AHUs) and concluded that the AHUs are in proper working order with no leaks or standing water build up. The filters in AHU 1 were clean and free of visible dust and debris.

The following recommendations are offered to improve air quality in this building:

1. Communicate the findings of this report to the staff, and health and safety representitive;
2. Review the HVAC system settings and investigate whether there is a means of increasing humidity during winter months,
3. In the event of widespread occupant complaint, consider reviewing temperature set points.

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1.0 INTRODUCTION AND SCOPE

1.1 Statement of Understanding

Pinchin Ltd. (Pinchin) was retained by University of Manitoba (the Client) to conduct an investigation of indoor air quality (IAQ) that included 24-hour monitoring. The work was conducted at 30A Sifton Road, Winnipeg, Manitoba. Room 403 of the Allen Building was the data logging location chosen by the client as it was occupied by staff and students during the hours of 08:30 – 11:30, and 14:30 – 17:30. Room 403 is located on the 4th floor of the Allen Building at the Fort Garry campus. The client also requested that in this location, observations be made specifically to the cleanliness of supply air diffusers and return air grilles. As well as an inspection of the Heating Ventilation Air Conditioning (HVAC) system was requested.

1.2 Scope of Work

Pinchin performed the investigation from March 11, 2022 to March 12, 2022. The scope of this investigation was limited to Room 403. As well as the HVAC system on the 100 Floor Level.

The investigation involved the following activities:

- Walkthrough site reviews for factors that could degrade air quality.
- Site review of HVAC equipment servicing the entire building; and
- Data-logging of Carbon Dioxide (CO_2), Carbon Monoxide (CO), Temperature (Temp), Relative Humidity (RH), Total Volatile Organic Compounds (TVOCs) and Particulate Matter smaller than 2.5 micrometres ($PM_{2.5}$) within Room 403.

2.0 METHODOLOGY

2.1 Interviews and Site Reviews

Pinchin interviewed the University of Manitoba Physical Plant, Project and Building Managers to discuss the history of the building, maintenance practices and any indoor air quality concerns.

The investigator did not perform any destructive work to inspect concealed conditions inside wall and/or ceiling cavities.

2.2 Test Methods and Criteria

The following table presents the parameters measured in this investigation, the applicable units of measurement, and the Indoor Air Quality criteria used for the evaluation of the results.

Table I – IAQ Parameters Tested, Measurement Criteria and Instruments

Parameter	Unit of Measurement	Recommended Limit	Instrumentation
Carbon dioxide, CO_2	Parts per million in air (ppm)	Outdoor Air (ppm) + 700 ppm [1]	24 hour Data-log Monitoring using a 3M® EVM-7 Air Quality Monitor
Carbon monoxide, CO	ppm	5 ppm [2]	
Temperature, T	°C	21 to 25 °C, winter clothing [3]	
Relative Humidity, RH	%RH	25[4] to 65[5] %, for occupant comfort	
Total Volatile Organic Compounds, (TVOC)	Parts per billion (ppb)	400 ppb[6]	
Particulate Matter smaller than 2.5 micrometres, $PM_{2.5}$	µg/m³	25 µg/m³ [7]24-hour mean;	24 hour Data-log Monitoring using an EVM-7 Air Quality Monitor

All data-logging direct-reading instruments were calibrated before use.

3.0 FINDINGS

3.1 Results of Interviews

Project or Building Manager reported the following:

- Air Handling Units (AHU) filters are changed every three months or as needed;
- The occupant capacity within Room 403 is 80 people; and
- The enrollment/class ranges from 30 to 70 people.

1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Ventilation for Acceptable Indoor Air Quality* [ANSI/ASHRAE Standard 62.1-2019]. Atlanta, GA: ASHRAE, 2019.
2 Health Canada: *Indoor Air Quality in Office Buildings: A Technical Guide*. Ottawa, ON: Health Canada, 1995.
3 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Thermal Environmental Conditions for Human Occupancy* [ANSI/ASHRAE Standard 55-2020]. Atlanta, GA: ASHRAE, 2020.
4 L.E. Burton, J.G. Girman, S.E. Womble: Airborne particulate matter within 100 randomly selected office buildings in the United States (BASE). Proceedings of Healthy Buildings 2000, Vol. 1 (2001).
5 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Thermal Environmental Conditions for Human Occupancy* [ANSI/ASHRAE Standard 55-2020]. Atlanta, GA:ASHRAE, 2020.
6 Value calculated from: US Environmental Protection Agency (EPA) "Building Assessment Survey and Evaluation (BASE) Study [Online] Available at http://www.epa.gov/iaq/base/summarized_data.html#Volatile_Organic_Compounds (Accessed August 25, 2014).
7 W. Team, "WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide : global update 2005 : summary of risk assessment", Apps.who.int, 2021. [Online]. Available: http://apps.who.int/iris/handle/10665/69477. [Accessed: 15-Sep- 2021].

3.2 Facility Description

Table II – Facility Description

Item	Details
Construction Date	1905
Number of Floors	Six Floors above grade, 1 Floor below grade
Structural Type	Steel
Foundation Type	Concrete
Exterior Cladding	Brick
HVAC	Forced air
Roof	Built up
Flooring	Vinyl sheet flooring
Interior Walls	Drywall
Ceilings	Acoustic ceiling tile

3.3 Results of Site Reviews

Appendix I presents the drawings.

There is one Air Handling Unit within the Allen Building. AHU 1 provides air to the entire building (Photo #1). Inside the AHU there were no leaks or standing water (Photo #2) and the filters fit properly and were observed to be clear (Photo #3). AHU 1 condensate drain is free from leaks and standing water (Photo # 4).

In the sampling location there were observed to be perimeter supply diffusers (Photo #5) and return grates on the doors (Photo #6). All supply diffusers and return grilles were clean and free from obstructions.

The filters in AHU 1 are Minimum Efficiency Reporting Value (MERV) of 8. AHU 1 has 10 Air Changes per Hour and a Run Time of 24-7. There is no humidification system installed.

Refer to Table III for photographs from the investigation.

Table III – Photographs from Investigation

Photo 1 - AHU 1

Photo 2 - Inside AHU 1 free from leaks and standing water

Photo 3 - AHU 1 filters (clean)

Photo 4 - AHU 1 condensate drain free from leaks and standing water

Photo 5 - Room 403 perimeter supply diffuser

Photo 6 - Room 403 Return grate on doors

3.4 Results of Indoor Air Quality Tests

Appendix II presents the results of data-logging for IAQ parameters.

The EVM 7 air monitor was used for 24-hour data logging, for just $PM_{2.5}$, CO_2, CO, TVOC, Temperature, and Relative Humidity. The EVM-7 is a direct-reading instrument and were calibrated before use.

3.4.1 Carbon Dioxide (CO_2)

The 24-hour minimum CO_2 concentration recorded within the building was 364 ppm, the maximum CO_2 concentration was 464 ppm. The 24-hour average for CO_2 was 386 ppm. The average CO_2 concentration during **the occupied time** was 411 ppm. On March 11 and March 12 outdoor spot measurements were recorded. The average outdoor CO2 spot measurements for the two days was 409 ppm. The indoor carbon dioxide concentrations were below the limit of 1,109 ppm (409 ppm outdoors plus 700 ppm) recommended by American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE). This indicates that the supply of outdoor air was adequate for the occupancy loading at the time of the investigation.

3.4.2 Carbon Monoxide (CO)

The carbon monoxide concentrations were non-detectable or just at the detection limit of the instrumentation for the duration of the 24-hour datalogging. Health Canada advises that the detection of carbon monoxide above 5 ppm indicates a concern requiring further investigation.

3.4.3 Temperature (Temp)

The 24-hour minimum temperature measurement was 18.5 °C, the maximum temperature measurement was 21.3 °C. The 24-hour average temperature measurement was 20.3 °C. The average temperature measurement during **the occupied time** was 20.8 °C. On March 11 and March 12 outdoor spot measurements were taken each day, averaging -22.0 °C for the two days. The indoor temperatures were slightly outside the recommended comfort range for commercial environments for typical dress during winter conditions, of 21 to 25 °C.

3.4.4 Relative Humidity (RH)

The 24-hour minimum Relative Humidity measurement was 2.6 %RH, the maximum measurement was 6.6 %RH. The 24-hour average measurement for relative humidity was 3.9 %RH. The average relative humidity measurement during **the occupied time** was 3.67 %RH. On March 11 and March 12 outdoor spot measurements were taken each day, averaging 65 %RH for the two days. Relative humidity below 25 %RH may result in complaints of dry skin and eye and nose irritation. Low relative humidity is a common winter time condition in Canada due to difficulties with humidification.

3.4.5 Particulate Matter ($PM_{2.5}$)

The 24-hour minimum concentration for $PM_{2.5}$ was below the detection limit of the monitoring instrument, the maximum concentration for $PM_{2.5}$ was 46 µg/m³. The 24-hour average concentration for $PM_{2.5}$ was 2 µg/m³. The average $PM_{2.5}$ concentrations during the occupied time was 1.5 µg/m³. On March 11 and March 12 outdoor spot measurements were taken each day, averaging 9 µg/m³ for these dates. For reference, World Health Organization (WHO) provides a guideline of 25 µg/m³ over a 24-hour period. The indoor $PM_{2.5}$ concentrations in this building were within the recommended range. There were various spikes for a limited time, they are as follows:

- March 11 at 13:51 to 13:53: for 2 minutes and range from 27 to 28 µg/m³;
- March 11 at 14:06 to 14:10: for 4 minutes and range from 35 to 40 µg/m³.

Although there are two occasions of spikes, they are of short duration and the average during **the occupied time** is well below the recommended measurement.

3.4.6 Total Volatile Organic Compounds (TVOC)

The TVOC concentrations were non-detectable or just at the detection limit of the instrumentation for the duration of the 24-hour monitoring. Based on US EPA research, office environments with TVOC concentrations up to 400 ppb would be at little risk of IAQ concern. As this is a guideline, complaints might be expected if concentrations were significantly above 400 ppb.

Table IV – Summary of 24-Hour Data-logging IAQ based on Indoor Air Quality Criteria

Parameter	**Measurement Average**	**Indoor Air Quality Measurement Criteria**	**Below Indoor Air Quality Measurement Criteria?**
Carbon Dioxide	386 ppm	Outdoor Air (ppm) + 700 ppm	Yes
Carbon Monoxide	**Below the Detection Limit of the Monitoring Instrument**	5ppm	Yes
Temperature (°C)	20.3 °C	21 to 25 °C, winter clothing	No

Table IV – Summary of 24-Hour Data-logging IAQ based on Indoor Air Quality Criteria

Relative Humidity (%)	3.9 %	25 to 65 %, for occupant comfort	No
$PM_{2.5}$	2 µg/m³	25 µg/m³	Yes
TVOC	**Below the Detection Limit of the Monitoring Instrument**	400 ppb	Yes

4.0 DISCUSSION

The majority of the indoor air quality measurements collected were within recommended ranges and meet the criteria of the guidelines referenced. Carbon dioxide concentrations suggested adequate ventilation. Carbon monoxide concentrations did not suggest the presence of exhaust or combustion gases. Temperature measurements were within the recommended comfort ranges for office environments. $PM_{2.5}$ average concentrations were within typical ranges. Total Volatile Organic Compound (TVOC) concentrations were within the recommended range. As well the Pinchin inspector did not identify any deficiencies with regards to unusual odours during the investigation.

Relative Humidity measurements were below the recommended comfort range which may result in dry skin, eye and nose irritation. However, it should be noted that low relative humidity is a common wintertime condition in Canada.

Temperature measurements were slightly below the recommended comfort range for commercial environments within Room 403. Temperature preferences are, however, very personal and these conditions might be acceptable to the occupants.

Pinchin inspected the Air Handling Units (AHUs) and concluded that the AHUs are in proper working order with no leaks or standing water build up. The filters in AHU 1 were clean and free of visible dust and debris.

5.0 RECOMMENDATIONS

Pinchin offers the following recommendations to improve air quality in this building.

1. Communicate the findings of this report to the staff, and health and safety representitive;
2. Review the HVAC system settings and investigate whether there is a means of increasing humidity during winter months,
3. In the event of widespread occupant complaint, consider reviewing temperature set points.

6.0 TERMS AND LIMITATIONS

This work was performed subject to the Terms and Limitations presented or referenced in the proposal for this project.

Information provided by Pinchin is intended for Client use only. Pinchin will not provide results or information to any party unless disclosure by Pinchin is required by law. Any use by a third party of reports or documents authored by Pinchin or any reliance by a third party on or decisions made by a third party based on the findings described in said documents, is the sole responsibility of such third parties. Pinchin accepts no responsibility for damages suffered by any third party as a result of decisions made or actions conducted. No other warranties are implied or expressed.

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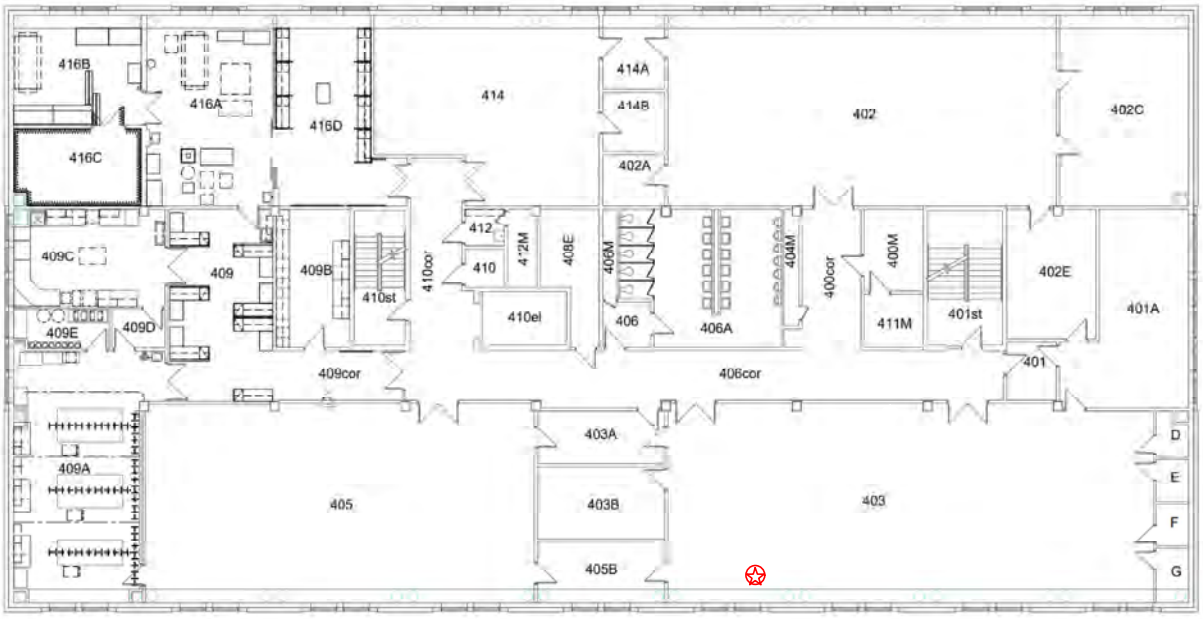
Template: Master Report Investigation of IAQ, IEQ, September 15, 2021

APPENDIX I

Drawing



N

LEGEND

DATA LOGGING LOCATION

BASE PLAN PROVIDED BY CLIENT.

PINCHIN

PROJECT NAME:
INDOOR AIR QUALITY ASSESSMENT

CLIENT NAME:
UNIVERSITY OF MANITOBA

PROJECT LOCATION:
ALLEN BUILDING
30A SIFTON ROAD
WINNIPEG, MANITOBA

FIGURE NAME:
LEVEL 400

PROJECT NUMBER:	SCALE:
306866	NOT TO SCALE
DRAWN BY:	REVIEWED BY:
CE	JB
DATE:	FIGURE NUMBER:
APRIL 2022	1 OF 1

APPENDIX II

Results of Data-Logging Indoor Air Quality Measurements

Session Report
Allen Building, Room 403
30A Sifton Road

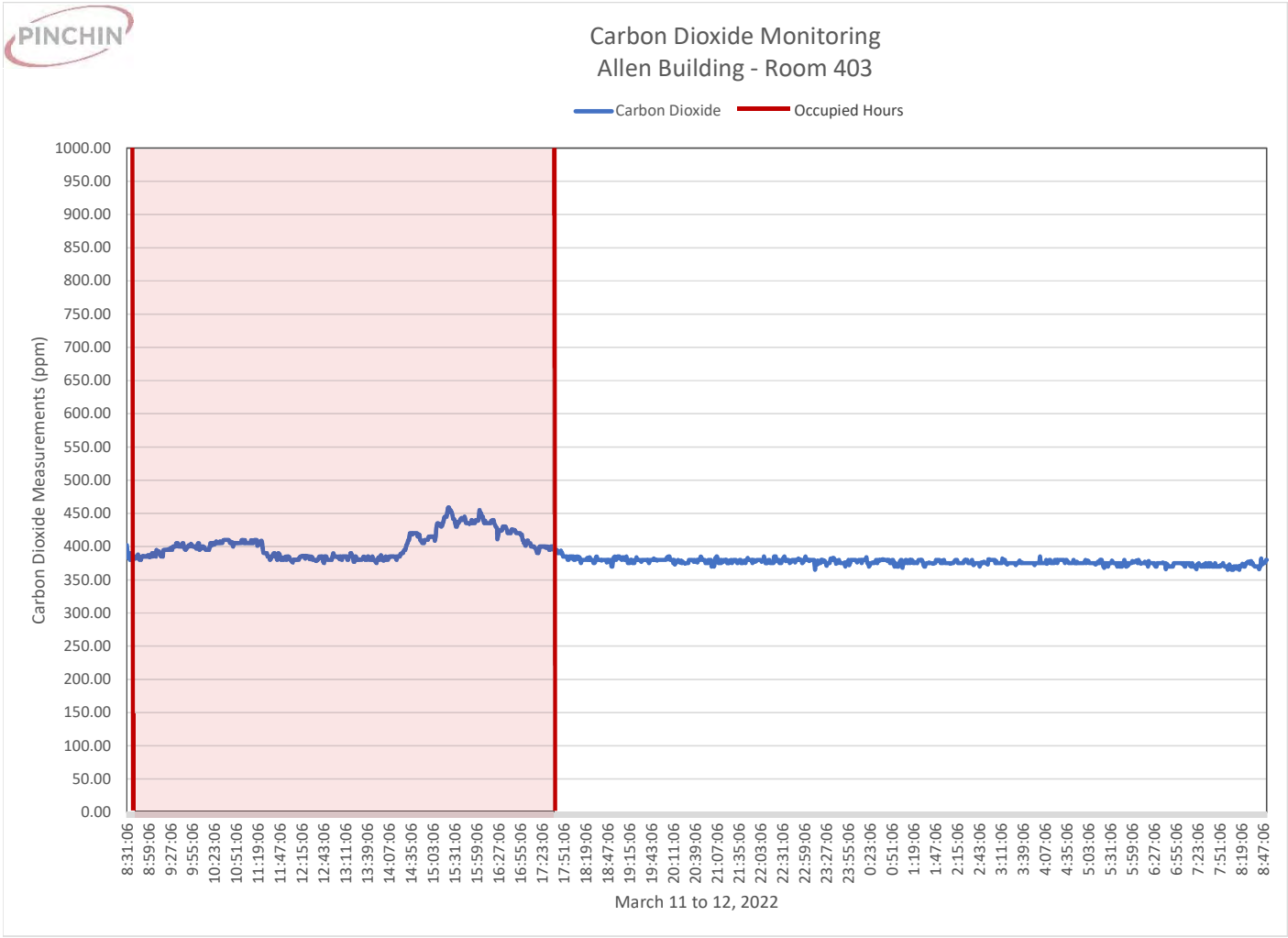
3/12/2022

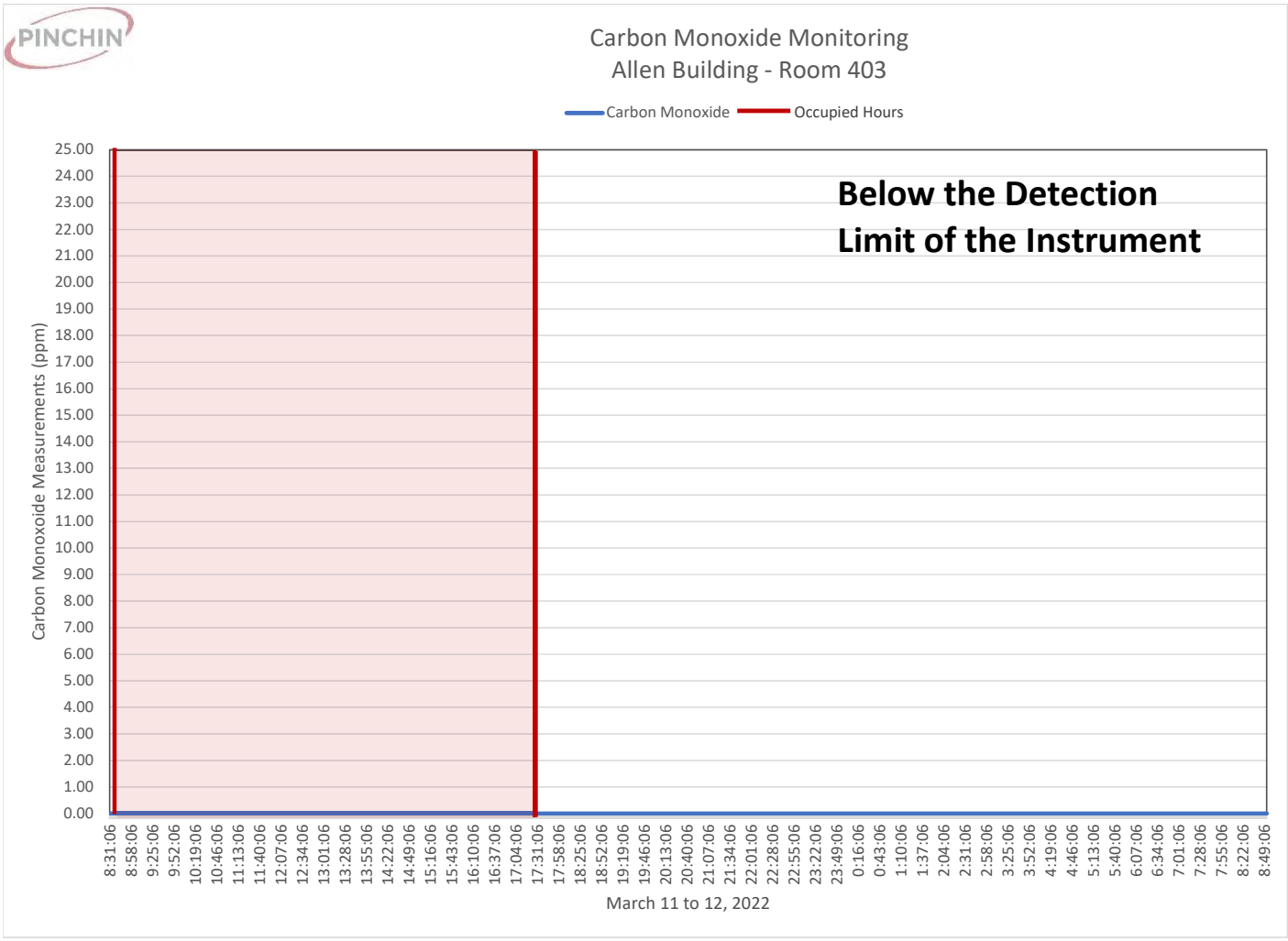
Datalog Period

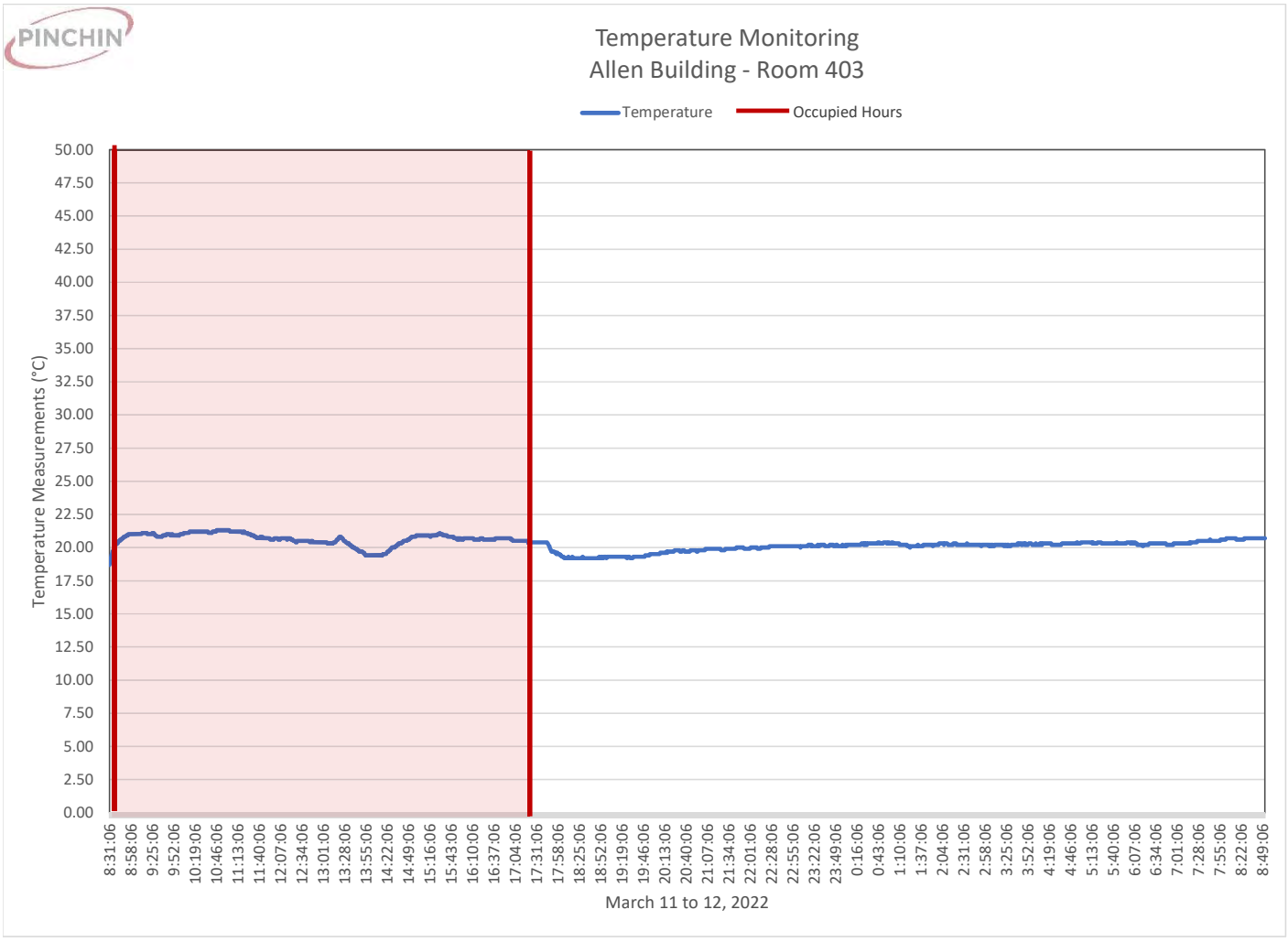
Device Name	EML060008
Serial Number	EML060008
Run Time	1.00:19:09
Start Time	3/11/2022 8:30:06 AM
Stop Time	3/12/2022 8:49:15 AM

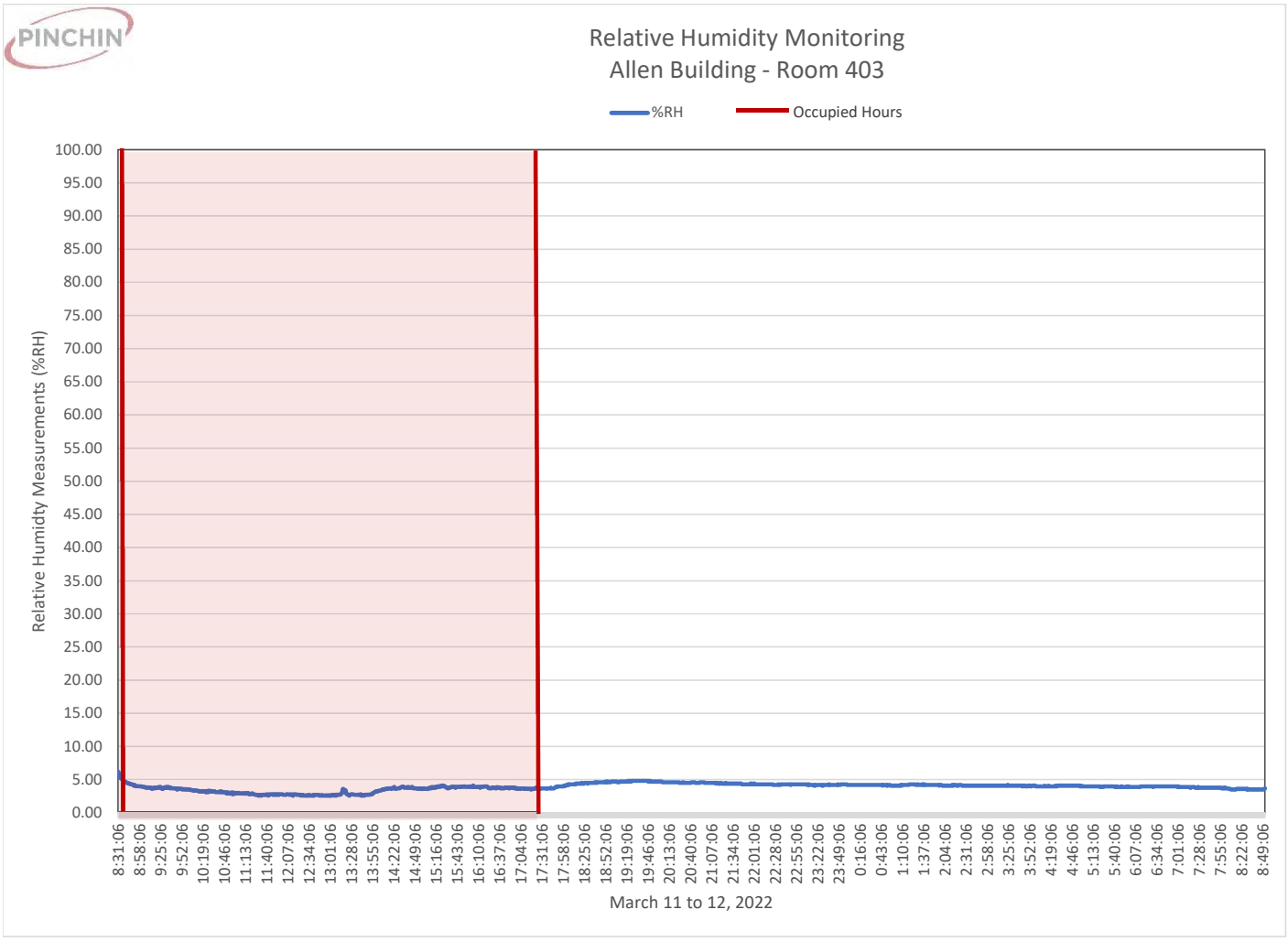
IAQ Data Summary

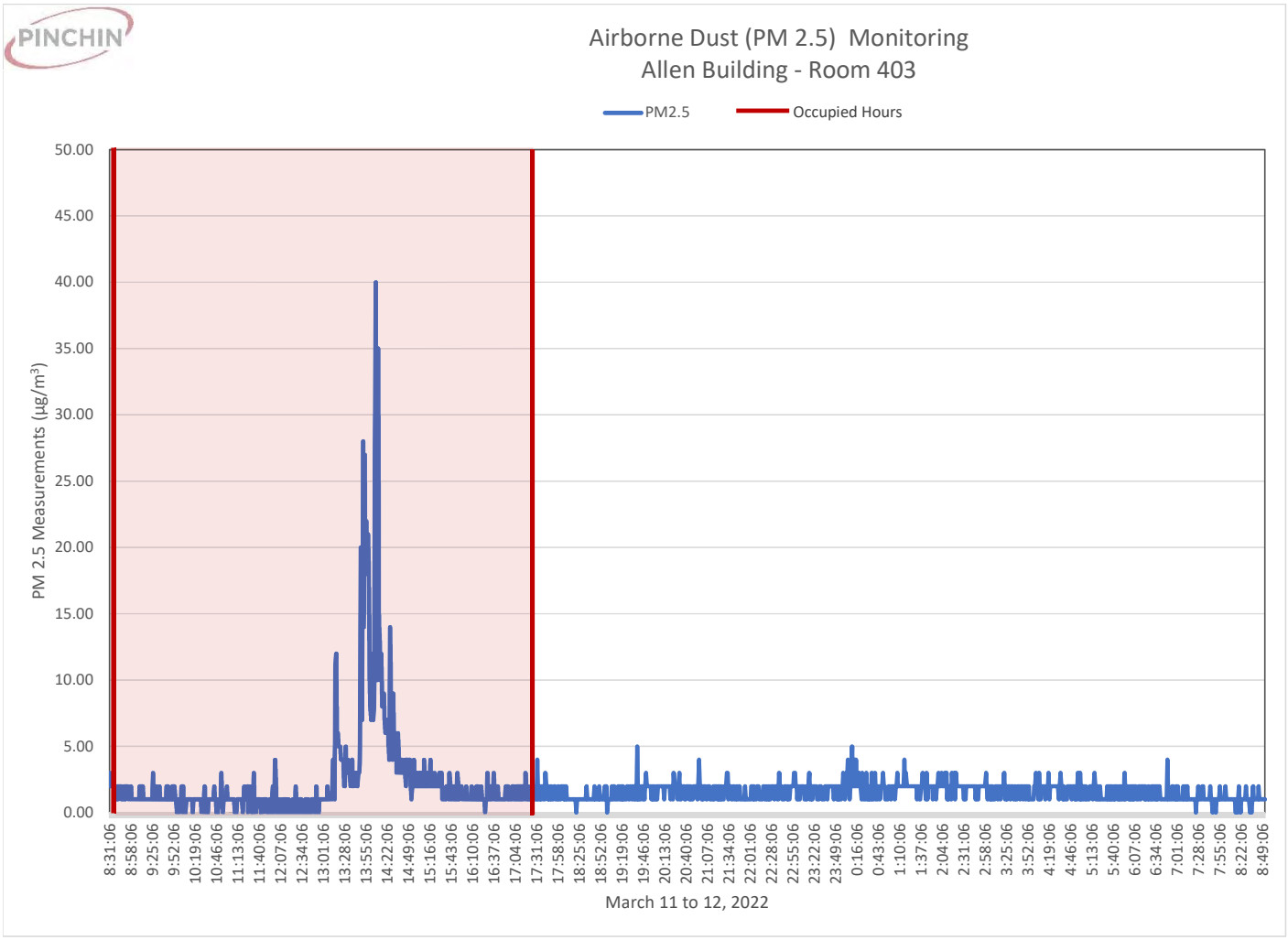
Description	Value	Description	Value
CO2Ave	386 PPM	CO2Max	464 PPM
CO2MaxTime	3/11/2022 8:30:18 AM	CO2Min	364 PPM
COAve	0 PPM	COMax	0 PPM
COMin	0 PPM	Dust Average	2.000 ug/m³
Dust Max	46.000 ug/m³	Dust Min	0.000 ug/m³
Humidity Avg	3.9 %	Humidity Max	6.6 %
Humidity Max Time	3/11/2022 8:30:23 AM	Humidity Min	2.6 %
Humidity Min Time	3/11/2022 1:25:51 PM	PIDAvePPB	Below the Detection Limit of the Instrument
PIDMaxPPB	Below the Detection Limit of the Instrument	PIDMinPPB	Below the Detection Limit of the Instrument
Temp Avg	20.3 °C	Temp Max Time	3/11/2022 10:55:27 AM
Temp Min Time	3/11/2022 8:30:06 AM	Temperature Max	21.3 °C
Temperature Min	18.5 °C		
Dust Impactor Setting	2.5 µm		

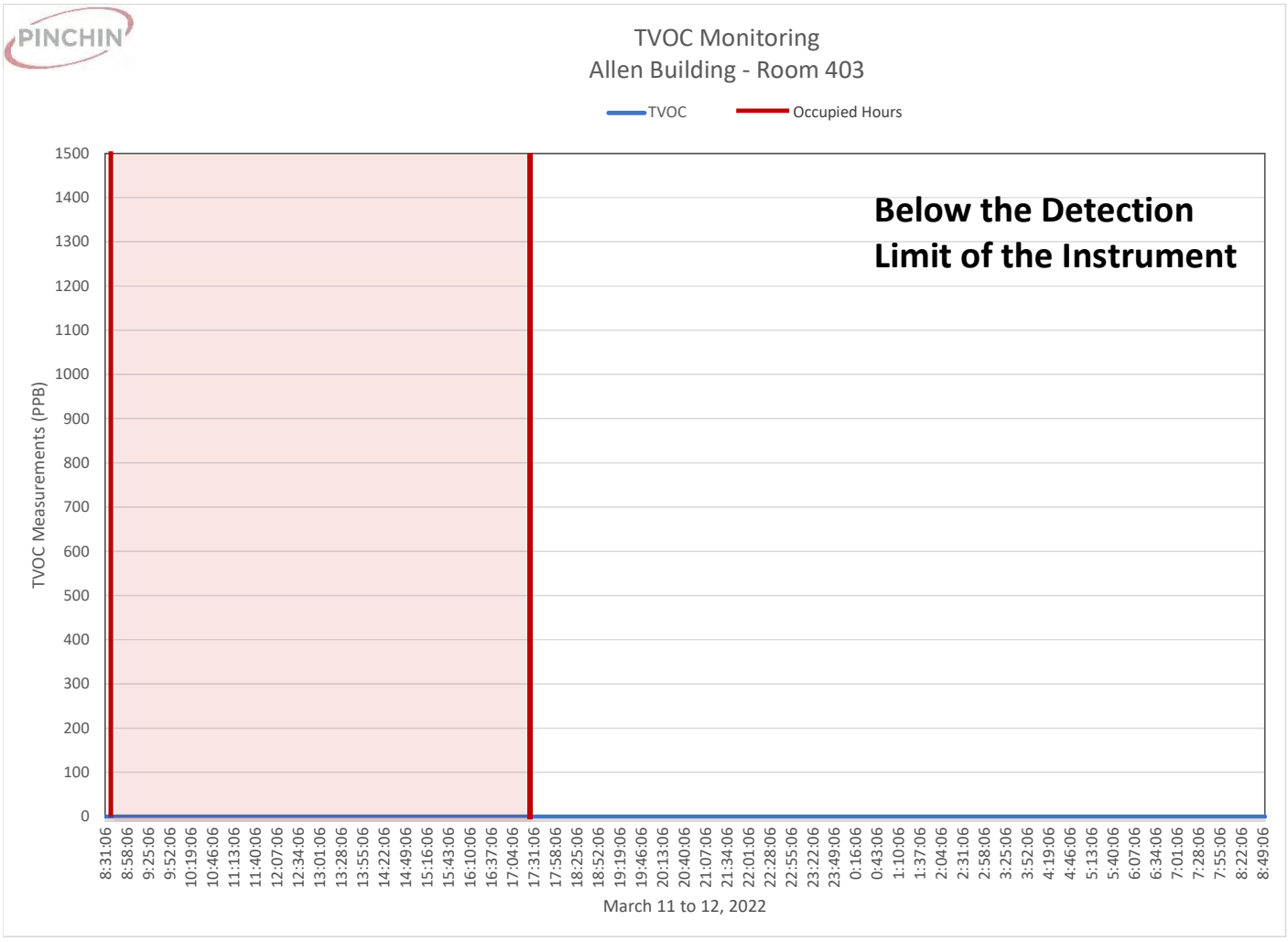

PINCHIN
Carbon Dioxide Monitoring
Allen Building - Room 403
Carbon Dioxide
Occupied Hours
Carbon Dioxide Measurements (ppm)
1000.00
950.00
900.00
850.00
800.00
750.00
700.00
650.00
600.00
550.00
500.00
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
8:31:06
8:59:06
9:27:06
9:55:06
10:23:06
10:51:06
11:19:06
11:47:06
12:15:06
12:43:06
13:11:06
13:39:06
14:07:06
14:35:06
15:03:06
15:31:06
15:59:06
16:27:06
16:55:06
17:23:06
17:51:06
18:19:06
18:47:06
19:15:06
19:43:06
20:11:06
20:39:06
21:07:06
21:35:06
22:03:06
22:31:06
22:59:06
23:27:06
23:55:06
0:23:06
0:51:06
1:19:06
1:47:06
2:15:06
2:43:06
3:11:06
3:39:06
4:07:06
4:35:06
5:03:06
5:31:06
5:59:06
6:27:06
6:55:06
7:23:06
7:51:06
8:19:06
8:47:06
March 11 to 12, 2022


PINCHIN
Carbon Monoxide Monitoring
Allen Building - Room 403
Carbon Monoxide
Occupied Hours
Below the Detection Limit of the Instrument
Carbon Monoxide Measurements (ppm)
25.00
24.00
23.00
22.00
21.00
20.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
8:31:06
8:58:06
9:25:06
9:52:06
10:19:06
10:46:06
11:13:06
11:40:06
12:07:06
12:34:06
13:01:06
13:28:06
13:55:06
14:22:06
14:49:06
15:16:06
15:43:06
16:10:06
16:37:06
17:04:06
17:31:06
17:58:06
18:25:06
18:52:06
19:19:06
19:46:06
20:13:06
20:40:06
21:07:06
21:34:06
22:01:06
22:28:06
22:55:06
23:22:06
23:49:06
0:16:06
0:43:06
1:10:06
1:37:06
2:04:06
2:31:06
2:58:06
3:25:06
3:52:06
4:19:06
4:46:06
5:13:06
5:40:06
6:07:06
6:34:06
7:01:06
7:28:06
7:55:06
8:22:06
8:49:06
March 11 to 12, 2022


PINCHIN
Temperature Monitoring
Allen Building - Room 403
Temperature
Occupied Hours
Temperature Measurements (°C)
50.00
47.50
45.00
42.50
40.00
37.50
35.00
32.50
30.00
27.50
25.00
22.50
20.00
17.50
15.00
12.50
10.00
7.50
5.00
2.50
0.00
8:31:06
8:58:06
9:25:06
9:52:06
10:19:06
10:46:06
11:13:06
11:40:06
12:07:06
12:34:06
13:01:06
13:28:06
13:55:06
14:22:06
14:49:06
15:16:06
15:43:06
16:10:06
16:37:06
17:04:06
17:31:06
17:58:06
18:25:06
18:52:06
19:19:06
19:46:06
20:13:06
20:40:06
21:07:06
21:34:06
22:01:06
22:28:06
22:55:06
23:22:06
23:49:06
0:16:06
0:43:06
1:10:06
1:37:06
2:04:06
2:31:06
2:58:06
3:25:06
3:52:06
4:19:06
4:46:06
5:13:06
5:40:06
6:07:06
6:34:06
7:01:06
7:28:06
7:55:06
8:22:06
8:49:06
March 11 to 12, 2022


PINCHIN
Relative Humidity Monitoring
Allen Building - Room 403
%RH
Occupied Hours
Relative Humidty Measurements (%RH)
100.00
95.00
90.00
85.00
80.00
75.00
70.00
65.00
60.00
55.00
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
8:31:06
8:58:06
9:25:06
9:52:06
10:19:06
10:46:06
11:13:06
11:40:06
12:07:06
12:34:06
13:01:06
13:28:06
13:55:06
14:22:06
14:49:06
15:16:06
15:43:06
16:10:06
16:37:06
17:04:06
17:31:06
17:58:06
18:25:06
18:52:06
19:19:06
19:46:06
20:13:06
20:40:06
21:07:06
21:34:06
22:01:06
22:28:06
22:55:06
23:22:06
23:49:06
0:16:06
0:43:06
1:10:06
1:37:06
2:04:06
2:31:06
2:58:06
3:25:06
3:52:06
4:19:06
4:46:06
5:13:06
5:40:06
6:07:06
6:34:06
7:01:06
7:28:06
7:55:06
8:22:06
8:49:06
March 11 to 12, 2022


PINCHIN
Airborne Dust (PM 2.5) Monitoring
Allen Building - Room 403
PM2.5
Occupied Hours
PM 2.5 Measurements (µg/m³)
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
8:31:06
8:58:06
9:25:06
9:52:06
10:19:06
10:46:06
11:13:06
11:40:06
12:07:06
12:34:06
13:01:06
13:28:06
13:55:06
14:22:06
14:49:06
15:16:06
15:43:06
16:10:06
16:37:06
17:04:06
17:31:06
17:58:06
18:25:06
18:52:06
19:19:06
19:46:06
20:13:06
20:40:06
21:07:06
21:34:06
22:01:06
22:28:06
22:55:06
23:22:06
23:49:06
0:16:06
0:43:06
1:10:06
1:37:06
2:04:06
2:31:06
2:58:06
3:25:06
3:52:06
4:19:06
4:46:06
5:13:06
5:40:06
6:07:06
6:34:06
7:01:06
7:28:06
7:55:06
8:22:06
8:49:06
March 11 to 12, 2022


PINCHIN
TVOC Monitoring
Allen Building - Room 403
TVOC
Occupied Hours
Below the Detection Limit of the Instrument
TVOC Measurements (PPB)
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
8:31:06
8:58:06
9:25:06
9:52:06
10:19:06
10:46:06
11:13:06
11:40:06
12:07:06
12:34:06
13:01:06
13:28:06
13:55:06
14:22:06
14:49:06
15:16:06
15:43:06
16:10:06
16:37:06
17:04:06
17:31:06
17:58:06
18:25:06
18:52:06
19:19:06
19:46:06
20:13:06
20:40:06
21:07:06
21:34:06
22:01:06
22:28:06
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23:22:06
23:49:06
0:16:06
0:43:06
1:10:06
1:37:06
2:04:06
2:31:06
2:58:06
3:25:06
3:52:06
4:19:06
4:46:06
5:13:06
5:40:06
6:07:06
6:34:06
7:01:06
7:28:06
7:55:06
8:22:06
8:49:06
March 11 to 12, 2022

FINAL

Investigation of Indoor Air Quality

Buller

45 Chancellor Circle, Winnipeg, Manitoba

Prepared for:

University of Manitoba
120 Physical Plant,
89 Freedman Crescent
Winnipeg, Manitoba, R3T 2N2

April 8, 2022

Pinchin File: 306866

Issued to:	**University of Manitoba**
Issued on:	**April 8, 2022**
Pinchin File:	**306866**
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EXECUTIVE SUMMARY

Pinchin Ltd. (Pinchin) was retained by University of Manitoba (the Client) to conduct an investigation of indoor air quality (IAQ) that included 24-hour monitoring. The work was conducted at 45 Chancellor Circle, Winnipeg, Manitoba. Room 312 of the Buller Building was the data logging location chosen by the client as it was occupied by staff and students during the hours of 8:30 – 11:30, and 14:30 – 17:30. Room 312 is located on the 3rd floor of the Buller building at the Fort Garry campus. The client also requested that in this location, observations be made specifically to the cleanliness of supply air diffusers and return air grilles.

Along with the 24 hour monitoring in Room 406 the client requested an inspection of the Heating Ventilation Air Conditioning (HVAC) system to determine if there were conditions present that could degrade air quality, i.e., dirty or wrongly fitted filters, presence of moisture, etc.

The majority of the indoor air quality measurements collected were within recommended ranges and meet the criteria of the guidelines referenced. Carbon dioxide concentrations suggested adequate ventilation. Carbon monoxide concentrations did not suggest the presence of exhaust or combustion gases. Temperature measurements were within the recommended comfort ranges for office environments. $PM_{2.5}$ concentrations were within typical ranges. Total Volatile Organic Compound (TVOC) concentrations were within the recommended range. As well the Pinchin inspector did not identify any deficiencies with regards to unusual odours during the investigation.

Relative Humidity measurements were below the recommended comfort range which may result in dry skin, eye and nose irritation. However, it should be noted that low relative humidity is a common wintertime condition in Canada.

Pinchin inspected the Air Handling Unit (AHU) and concluded that the AHU is in proper working order with no leaks or standing water build up. The filters in AHU-1 were clean and free of visible dust and debris.

Two water stained ceiling tiles were observed within Room 312. Ceiling tiles can support mould growth if subjected to persistent wetting. The water-stained ceiling tiles should be removed and replaced. New tiles should be monitored for evidence of recurring leaks and underlying repairs should made where necessary.

The following recommendations are offered to improve air quality in this building:

1. Communicate the findings of this report to the staff, and health and safety representitive;
2. Review the humidification system in the building to ensure it is operational and functioning properly. Consider making adjustments as necessary; and

3. Remove and replace the water stained ceiling tiles. Monitor the new tiles for any further staining. If water damage reoccurs the source of the damage should be identified and repaired.

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1.0 INTRODUCTION AND SCOPE

1.1 Statement of Understanding

Pinchin Ltd. (Pinchin) was retained by University of Manitoba (the Client) to conduct an investigation of indoor air quality (IAQ) that included 24 hour data-log monitoring. The work was conducted at 45 Chancellor Circle, Winnipeg, Manitoba. Room 312 of the Buller Building was the data logging location chosen by the client as it was occupied by staff and students during the hours of 8:30 – 11:30, and 14:30 – 17:30. Room 312 is located on the 3rd floor of the Buller building at the Fort Garry campus. The client also requested that in this location, observations be made specifically to the cleanliness of supply air diffusers and return air grilles.

1.2 Scope of Work

Pinchin performed the investigation from March 8, 2022 to March 9, 2022. The scope of this investigation was limited to Room 312, as well as the HVAC system on the 500 Floor Level.

The investigation involved the following activities:

- Walkthrough site reviews for factors that could degrade air quality;
- Site review of HVAC equipment servicing the entire building; and
- Data-logging of Carbon Dioxide (CO_2), Carbon Monoxide (CO), Temperature (Temp), Relative Humidity (RH), Total Volatile Organic Compounds (TVOCs) and Particulate Matter smaller than 2.5 micrometres ($PM_{2.5}$) within Room 312.

2.0 METHODOLOGY

2.1 Interviews and Site Reviews

Pinchin interviewed the University of Manitoba Physical Plant, Project and Building Managers to discuss the history of the building, maintenance practices and any indoor air quality concerns.

The investigator did not perform any destructive work to inspect concealed conditions inside wall and/or ceiling cavities.

2.2 Test Methods and Criteria

The following table presents the parameters measured in this investigation, the instruments used, the applicable units of measurement, and the Indoor Air Quality criteria used for the evaluation of the results.

Table I – IAQ Parameters Tested, Measurement Criteria and Instruments

Parameter	Unit of Measurement	Recommended Limit	Instrumentation
Carbon dioxide, CO_2	Parts per million in air (ppm)	Outdoor Air (ppm) + 700 ppm [1]	24 hour Data-log Monitoring using a 3M® EVM-7 Air Quality Monitor
Carbon monoxide, CO	ppm	5 ppm [2]	
Temperature, T	°C	21 to 25 °C, winter clothing [3]	
Relative Humidity, RH	%RH	25[4] to 65[5] %, for occupant comfort	
Total Volatile Organic Compounds, (TVOC)	Parts per billion (ppb)	400 ppb[6]	
Particulate Matter smaller than 2.5 micrometres, $PM_{2.5}$	µg/m³	25 µg/m³ [7]24-hour mean;	24 hour Data-log Monitoring using an EVM-7 Air Quality Monitor

All data-logging direct-reading instruments were calibrated before use.

3.0 FINDINGS

3.1 Results of Interviews

Project or Building Manager reported the following:

- Air Handling Units (AHU) filters are changed every three months or as needed;
- The occupant capacity within Room 312is 68 people; and
- The enrollment/class within Room 312 ranges from 22 to 32 people.

1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Ventilation for Acceptable Indoor Air Quality* [ANSI/ASHRAE Standard 62.1-2019]. Atlanta, GA: ASHRAE, 2019.
2 Health Canada: *Indoor Air Quality in Office Buildings: A Technical Guide*. Ottawa, ON: Health Canada, 1995.
3 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Thermal Environmental Conditions for Human Occupancy* [ANSI/ASHRAE Standard 55-2020]. Atlanta, GA: ASHRAE, 2020.
4 L.E. Burton, J.G. Girman, S.E. Womble: Airborne particulate matter within 100 randomly selected office buildings in the United States (BASE). Proceedings of Healthy Buildings 2000, Vol. 1 (2001).
5 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Thermal Environmental Conditions for Human Occupancy* [ANSI/ASHRAE Standard 55-2020]. Atlanta, GA:ASHRAE, 2020.
6 Value calculated from: US Environmental Protection Agency (EPA) "Building Assessment Survey and Evaluation (BASE) Study [Online] Available at http://www.epa.gov/iaq/base/summarized_data.html#Volatile_Organic_Compounds (Accessed August 25, 2014).
7 W. Team, "WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide : global update 2005 : summary of risk assessment", Apps.who.int, 2021. [Online]. Available: http://apps.who.int/iris/handle/10665/69477. [Accessed: 15-Sep- 2021].

3.2 Facility Description

Table II – Facility Description

Item	Details
Construction Date	1932
Number of Floors	Five floors above grade, one floor below
Structural Type	Steel
Foundation Type	Concrete
Exterior Cladding	Brick
HVAC	Forced air
Roof	Built up
Flooring	Vinyl sheet flooring
Interior Walls	Drywall
Ceilings	Acoustic ceiling tile

3.3 Results of Site Reviews

Appendix I presents the drawings.

There is one Air Handling Unit (AHU) within the Buller Building. AHU-1 provides air to the entire building. Inside the AHU there were no leaks or standing water (Photo #1) and the filters fit properly and were observed to be clear (Photo #2).

In the sampling location there were observed to be eight supply diffusers (Photo #3) and two return grates (Photo #4). All supply diffusers and return grilles were clean and free from obstructions.

Two water stained ceiling tiles were observed within Room 312 (Photo #5).

The filters in AHU-1 are Minimum Efficiency Reporting Value (MERV) of 8. AHU-1 has 12 Air Changes Per Hour and has a Run Time of 24-7.

Refer to Table III for photographs from the investigation.

Table III – Photographs from Investigation

Photo 1 - Inside AHU-1 free from leaks and standing water

Photo 2 - AHU-1 filters (clean)

Photo 3 - Room 312 supply diffuser (clean)

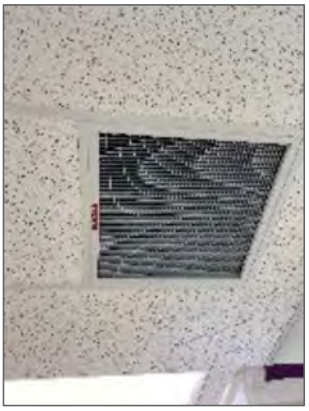


Photo 4 - Room 312 return grate (clean)

Photo 5 - Room 312 water stained ceiling tiles

3.4 Results of Indoor Air Quality Tests

Appendix II presents the results of data-logging for IAQ parameters.

The EVM 7 air monitor was used for 24-hour data logging, for just $PM_{2.5}$, CO_2, CO, TVOC, Temperature, and Relative Humidity. The EVM-7 is a direct-reading instrument and were calibrated before use.

3.4.1 Carbon Dioxide (CO_2)

The 24-hour minimum CO_2 concentration recorded within Room 312 was 436 ppm, the maximum CO_2 concentration was 525 ppm. The 24-hour average for CO_2 was 480 ppm. The average CO_2 concentration during **the occupied time** was 483 ppm. On March 8 and March 9 outdoor spot measurements were recorded. The average outdoor CO2 spot measurements for the two days was 445 ppm. The indoor carbon dioxide concentrations were below the limit of 1,180 ppm (480 ppm outdoors plus 700 ppm) recommended by American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE). This indicates that the supply of outdoor air was adequate for the occupancy loading at the time of the investigation.

Carbon Monoxide (CO)

The carbon monoxide concentrations were non-detectable or just at the detection limit of the instrumentation for the duration of the 24-hour datalogging. Health Canada advises that the detection of carbon monoxide above 5 ppm indicates a concern requiring further investigation.

3.4.2 Temperature (Temp)

The 24-hour minimum temperature measurement was 19.4 °C, the maximum temperature measurement was 23.1 °C. The 24-hour average temperature measurement was 22.2 °C. The average temperature measurement during **the occupied time** was 22.3 °C. On March 8 and March 9 outdoor spot measurements were taken each day, averaging -13.5 °C for these dates. The indoor temperatures were within the recommended comfort ranges for office environments for typical dress during winter conditions, of 21 to 25 °C.

3.4.3 Relative Humidity (RH)

The 24-hour minimum Relative Humidity measurement was 7.3 %RH, the maximum measurement was 22.2 %RH. The 24-hour average measurement for relative humidity was 10.7 %RH. The average relative humidity measurement during **the occupied time** was 13.2 %RH. On March 8 and March 9 outdoor spot measurements were taken each day, averaging 75.5 %RH for these dates. Relative humidity below 25 %RH may result in complaints of dry skin and eye and nose irritation. Low relative humidity is a common winter time condition in Canada due to difficulties with humidification.

3.4.4 Airborne Dust ($PM_{2.5}$)

The 24-hour minimum concentration for $PM_{2.5}$ was 1 µg/m³, the maximum concentration for $PM_{2.5}$ was 23 µg/m³. The 24-hour average concentration for $PM_{2.5}$ was 4 µg/m³. The average $PM_{2.5}$ concentration during **the occupied time** was 5 µg/m³. On March 8 and March 9 outdoor spot measurements were taken each day, averaging 5 µg/m³ for these dates. For reference, World Health Organization (WHO) provides a guideline of 25 µg/m³ over a 24-hour period. The indoor $PM_{2.5}$ concentrations in this building were within the recommended range.

3.4.5 Total Volatile Organic Compounds (TVOC)

The TVOC concentrations were non-detectable or just at the detection limit of the instrumentation for the duration of the 24-hour monitoring. Based on US EPA research, office environments with TVOC concentrations up to 400 ppb would be at little risk of IAQ concern. As this is a guideline, complaints might be expected if concentrations were significantly above 400 ppb.

Table IV – Summary of 24-Hour Data-logging IAQ based on University of Manitoba Measurement Criteria

Parameter	**Measurement Average**	**Indoor Air Quality Measurement Criteria**	**Below Indoor Air Quality Measurement Criteria?**
Carbon Dioxide	480 ppm	Outdoor Air (ppm) + 700 ppm	Yes
Carbon Monoxide	**Below the Detection Limit of the Monitoring Instrument**	5ppm	Yes
Temperature (°C)	22.2 °C	21 to 25 °C, winter clothing	Yes
Relative Humidity (%)	10.7 %	25 to 65 %, for occupant comfort	No

Table IV – Summary of 24-Hour Data-logging IAQ based on University of Manitoba Measurement Criteria			
$PM_{2.5}$	4 µg/m³	25 µg/m³	Yes
TVOC	**Below the Detection Limit of the Monitoring Instrument**	400 ppb	Yes

4.0 DISCUSSION

The majority of the indoor air quality measurements collected were within recommended ranges and meet the criteria of the guidelines referenced. Carbon dioxide concentrations suggested adequate ventilation. Carbon monoxide concentrations did not suggest the presence of exhaust or combustion gases. Temperature measurements were within the recommended comfort ranges for office environments. $PM_{2.5}$ concentrations were within typical ranges. Total Volatile Organic Compound (TVOC) concentrations were within the recommended range. As well the Pinchin inspector did not identify any deficiencies with regards to unusual odours during the investigation.

Relative Humidity measurements were below the recommended comfort range which may result in dry skin, eye and nose irritation. However, it should be noted that low relative humidity is a common wintertime condition in Canada.

Pinchin inspected the Air Handling Unit (AHU) and concluded that the AHU is in proper working order with no leaks or standing water build up. The filters in AHU-1 were clean and free of visible dust and debris.

Two water-stained ceiling tiles were observed within Room 312. Ceiling tiles can support mould growth if subjected to persistent wetting. The water-stained ceiling tiles should be removed and replaced. New tiles should be monitored for evidence of recurring leaks and underlying repairs should made where necessary.

5.0 RECOMMENDATIONS

Pinchin offers the following recommendations to improve air quality in this building:

1. Communicate the findings of this report to the staff, and health and safety representative;
2. Review the humidification system in the building to ensure it is operational and functioning properly. Consider making adjustments as necessary; and
3. Remove and replace the water-stained ceiling tiles. Monitor the new tiles for any further staining. If water damage reoccurs the source of the damage should be identified and repaired.

6.0 TERMS AND LIMITATIONS

This work was performed subject to the Terms and Limitations presented or referenced in the proposal for this project.

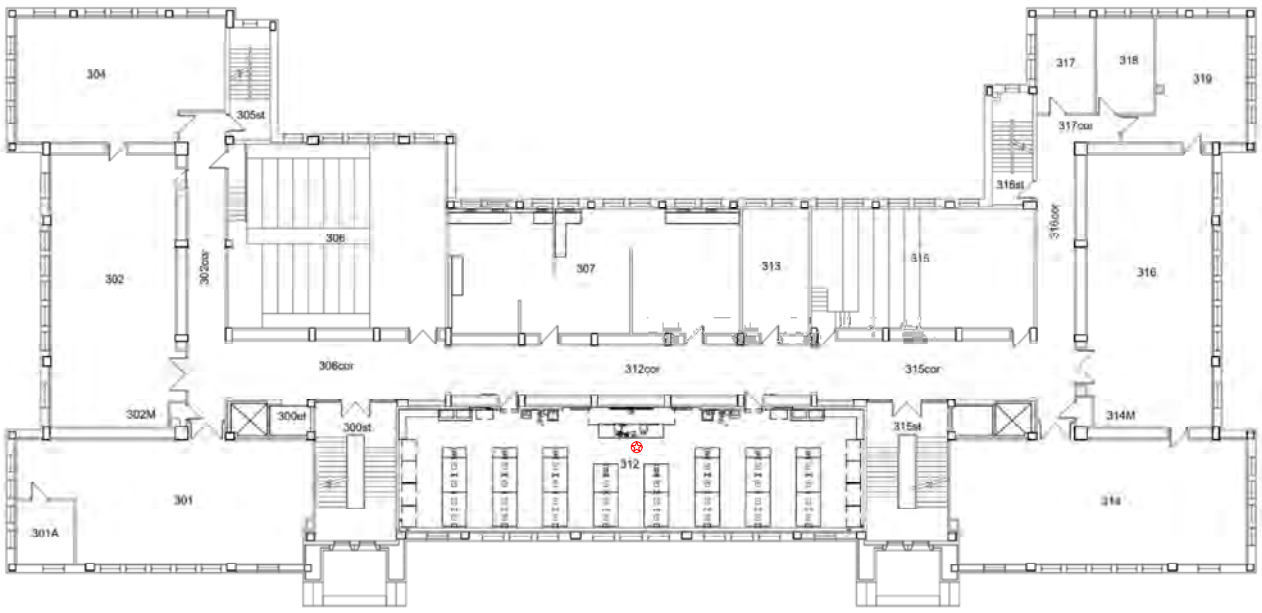
Information provided by Pinchin is intended for Client use only. Pinchin will not provide results or information to any party unless disclosure by Pinchin is required by law. Any use by a third party of reports or documents authored by Pinchin or any reliance by a third party on or decisions made by a third party based on the findings described in said documents, is the sole responsibility of such third parties. Pinchin accepts no responsibility for damages suffered by any third party as a result of decisions made or actions conducted. No other warranties are implied or expressed.

\\pinchin.com\wpg\Job\306000s\0306866.000 UofM,89FREEDMAN,IAQ,ASSMNT\Deliverables\Buller\306866 FINAL IAQ Report, 45 Chancellor Circle, Wpg, MB, UofM, Apr 8, 2022.docx

Template: Master Report Investigation of IAQ, IEQ, September 15, 2021

APPENDIX I

Drawing



N

LEGEND

DATA LOGGING LOCATION

BASE PLAN PROVIDED BY CLIENT.

PINCHIN

PROJECT NAME:
INDOOR AIR QUALITY ASSESSMENT

CLIENT NAME:
UNIVERSITY OF MANITOBA BULLER

PROJECT LOCATION:
45 Chancellor Circle
WINNIPEG, MANITOBA

FIGURE NAME:
LEVEL 300

PROJECT NUMBER:	SCALE:
306866	NOT TO SCALE
DRAWN BY:	REVIEWED BY:
CE	JB
DATE:	FIGURE NUMBER:
2022/03/17	1 OF 1

APPENDIX II

Results of Data-Logging Indoor Air Quality Measurements

Session Report
Buller Building
45 Chancellor Circle

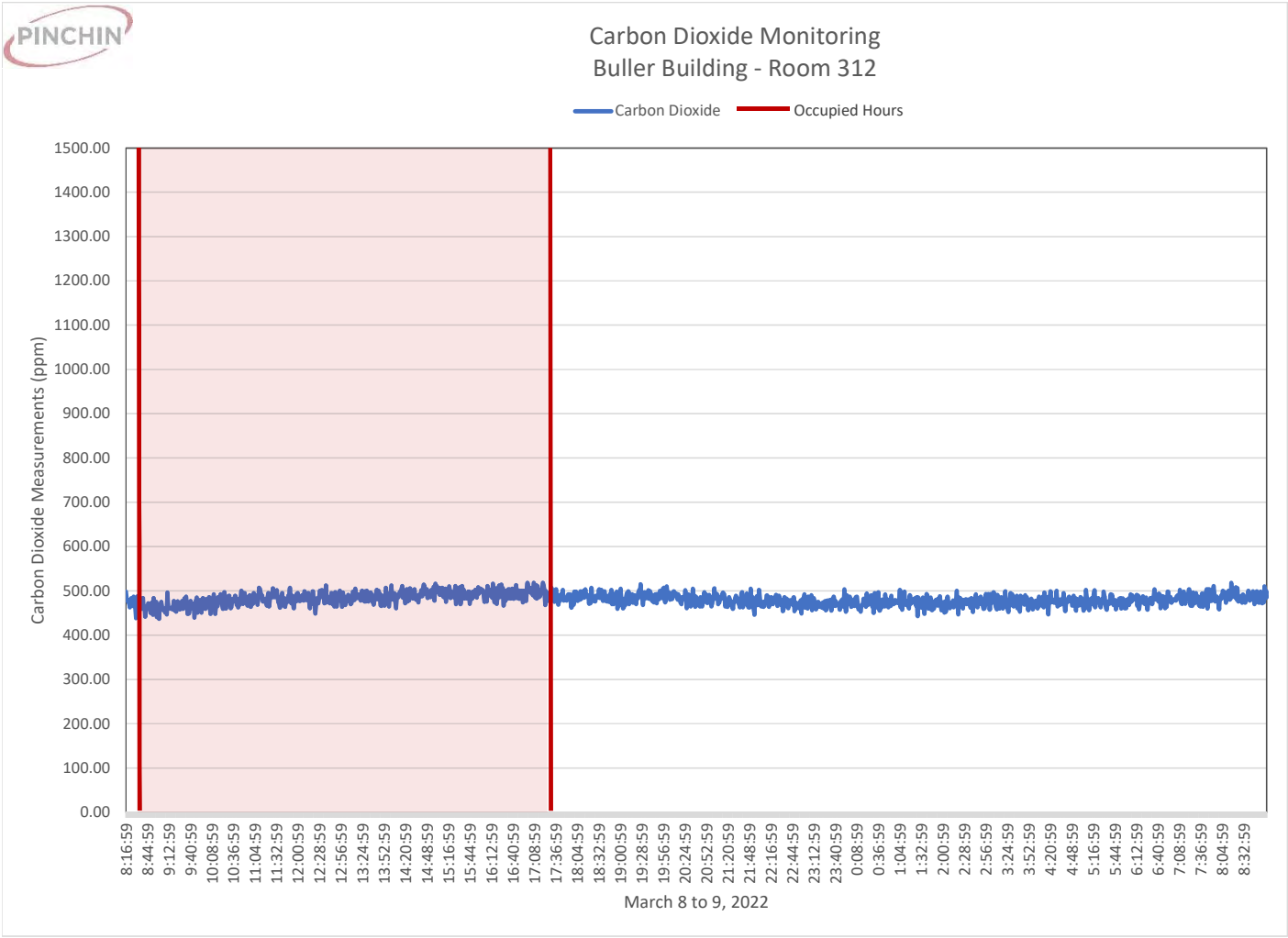
3/9/2022

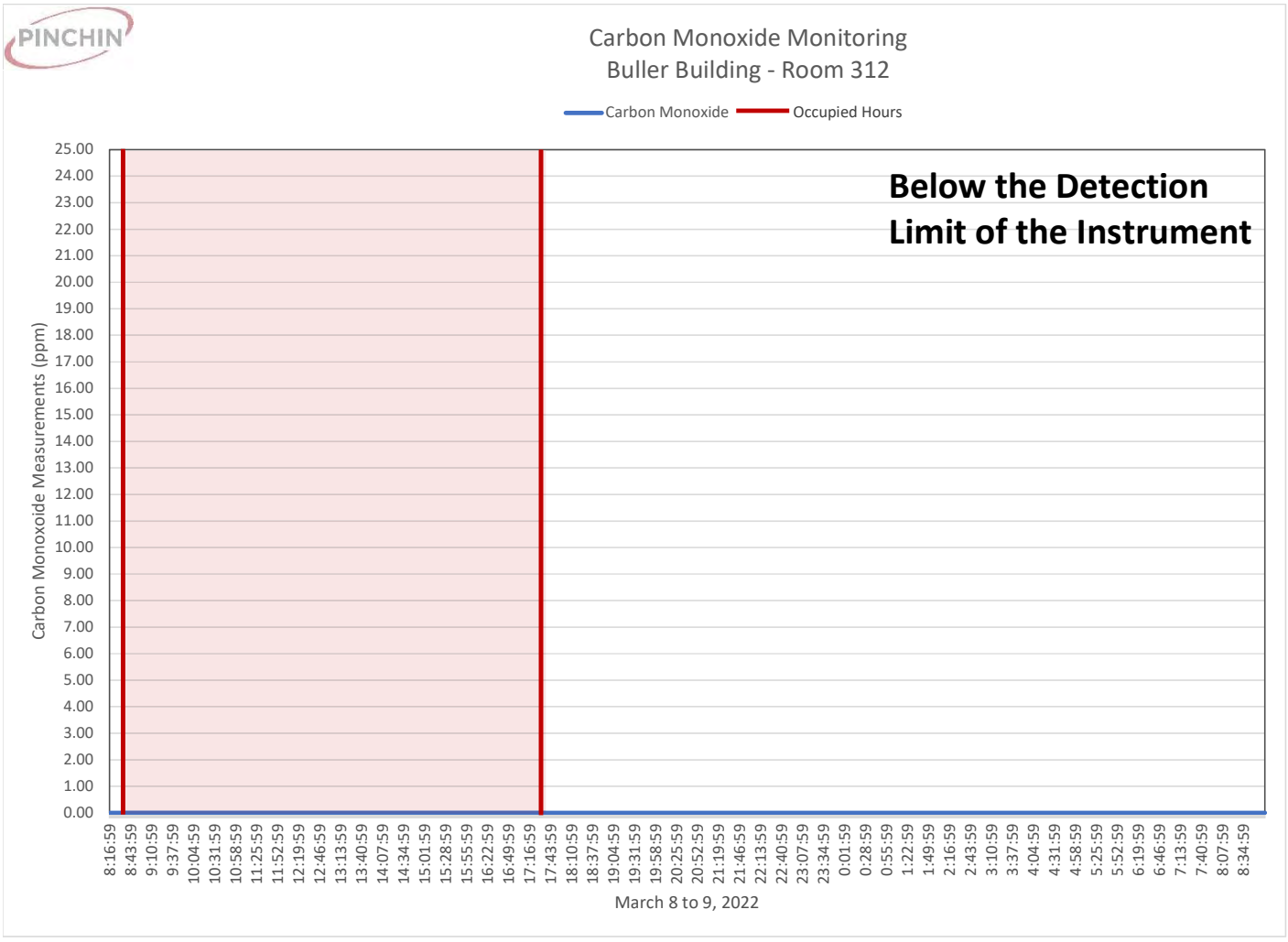
Datalog Period

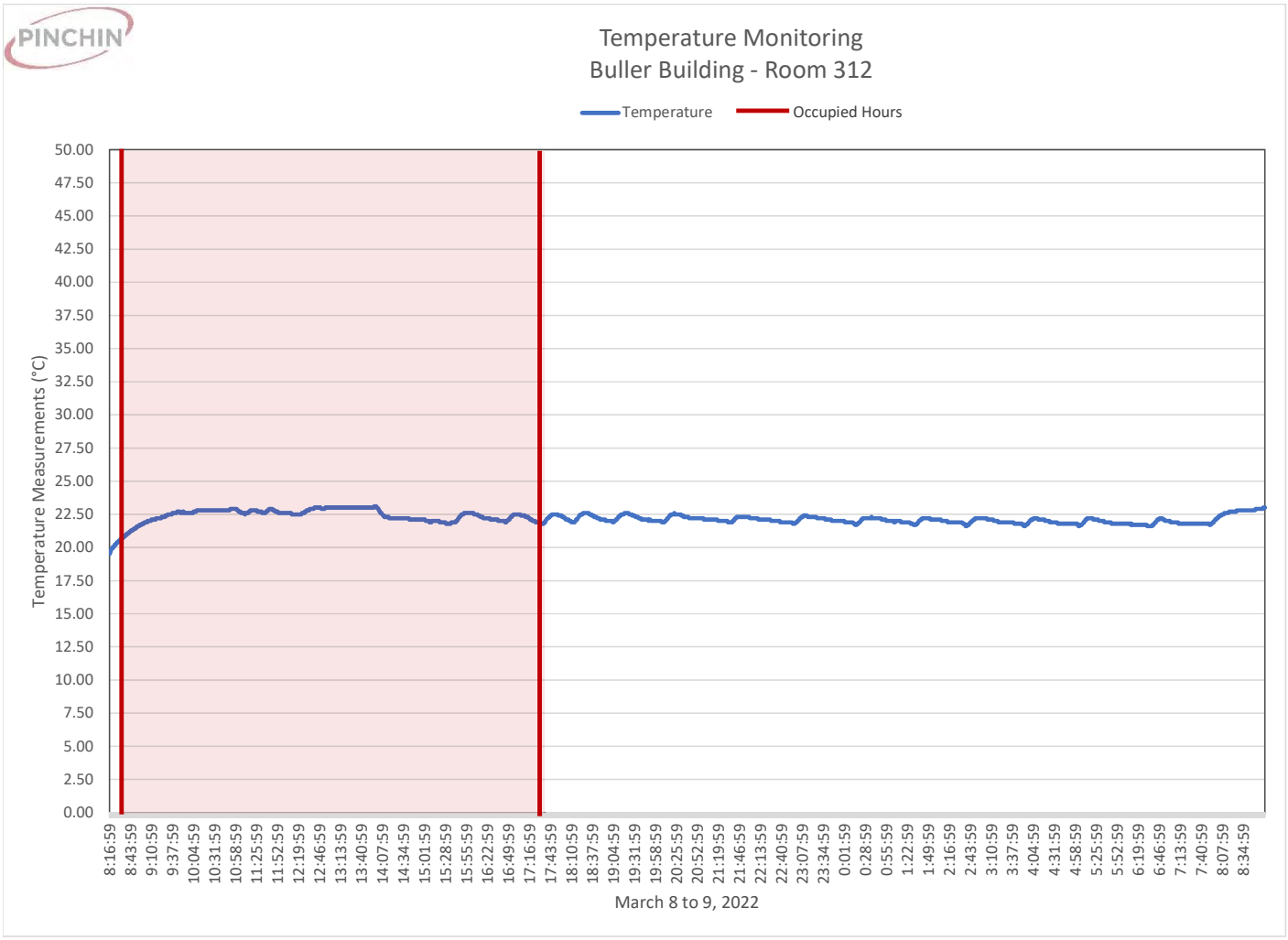
Device Name	EMI030004
Serial Number	EMI030004
Run Time	1.00:44:04
Start Time	3/8/2022 8:15:59 AM
Stop Time	3/9/2022 9:00:03 AM

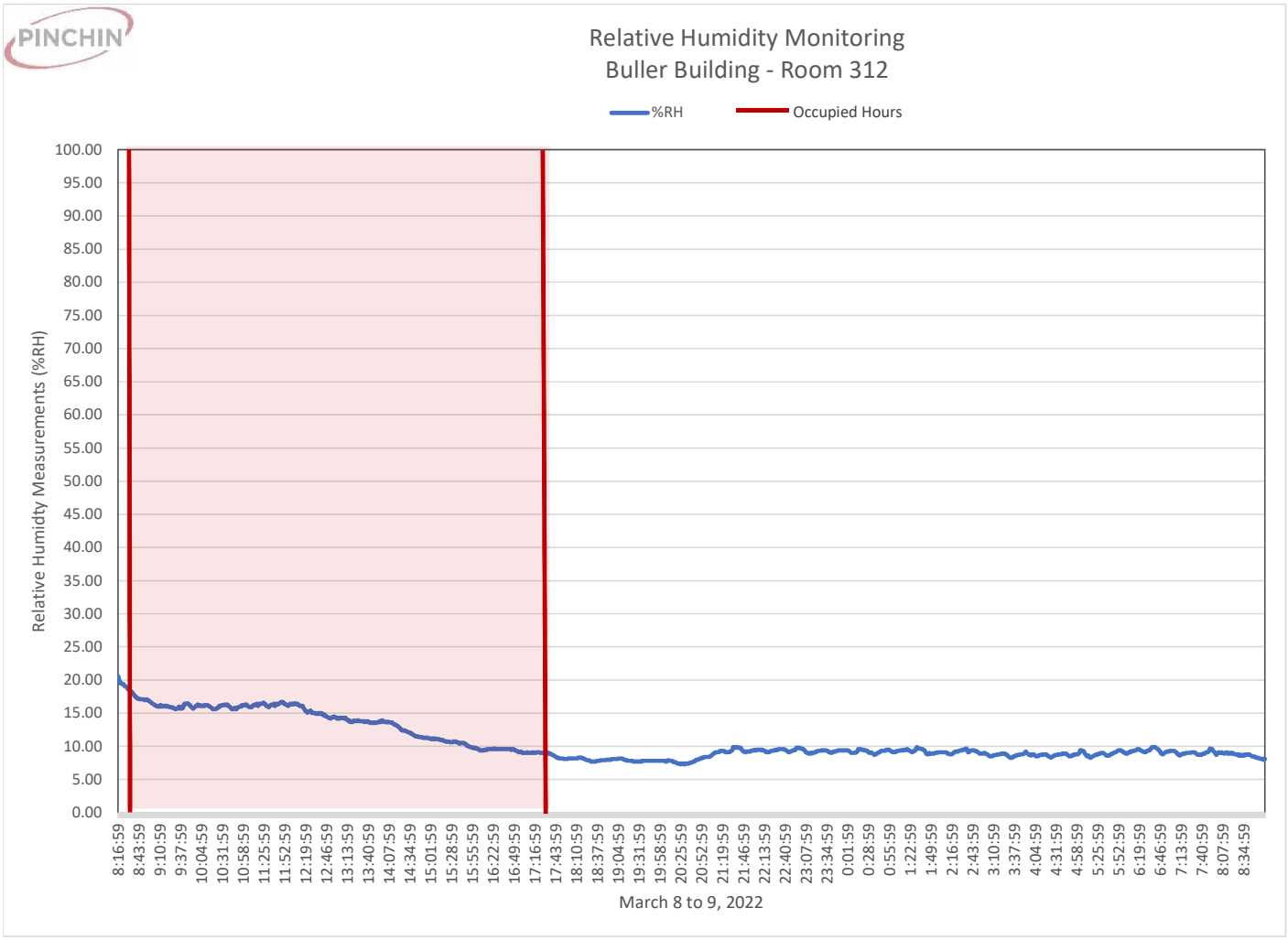
IAQ Data Summary

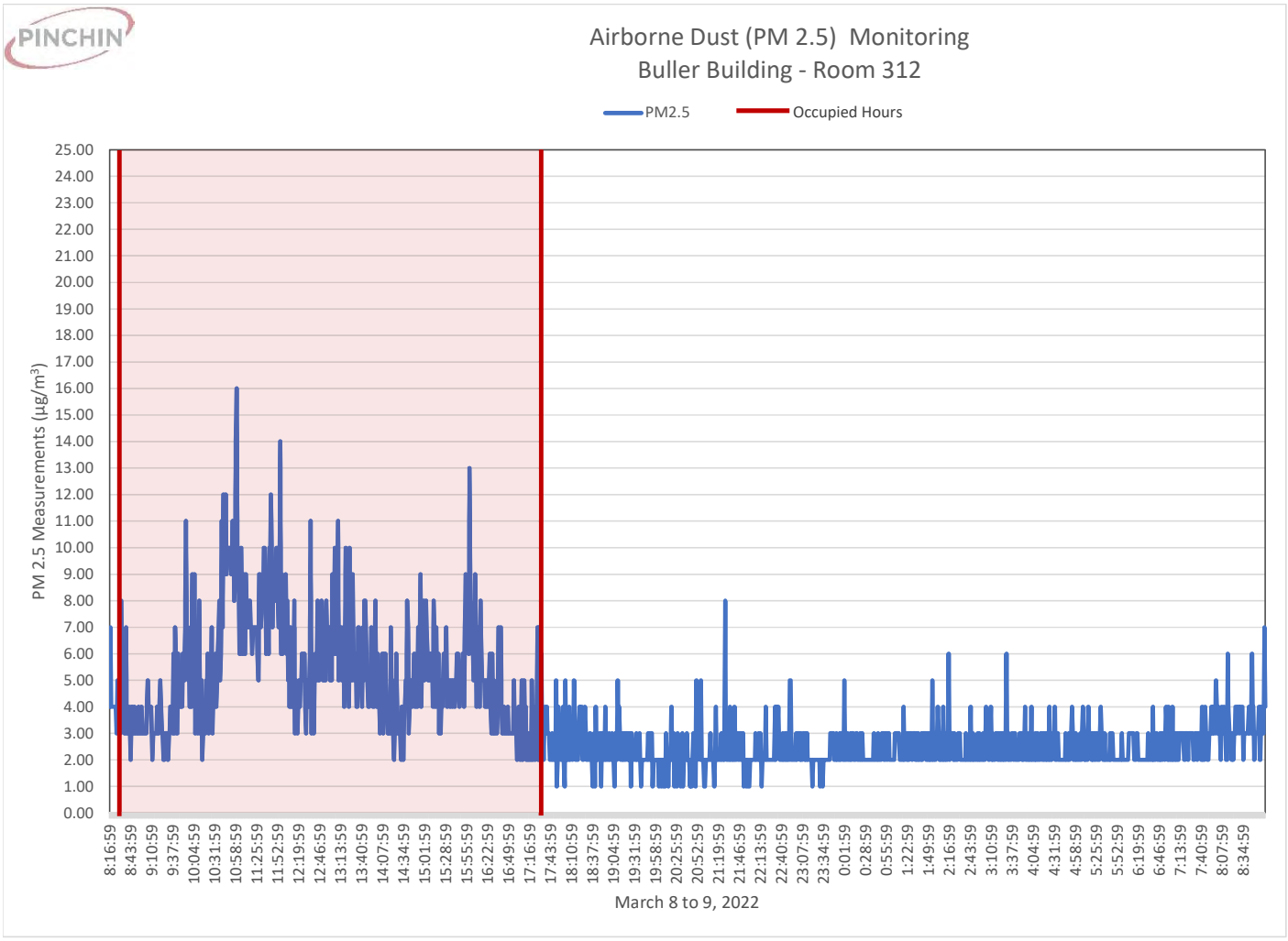
Description	Value	Description	Value
CO2Ave	480 PPM	CO2Max	525 PPM
CO2MaxTime	3/8/2022 5:20:00 PM	CO2Min	436 PPM
COAve	0 PPM	COMax	0 PPM
COMin	0 PPM	Dust Average	4.000 ug/m³
Dust Max	23.000 ug/m³	Dust Min	1.000 ug/m³
Humidity Avg	10.7 %	Humidity Max	22.2 %
Humidity Max Time	3/8/2022 8:16:04 AM	Humidity Min	7.3 %
Humidity Min Time	3/8/2022 8:24:54 PM	PIDAvePPB	Below the Detection Limit of the Monitoring Instrument
PIDMaxPPB	Below the Detection Limit of the Monitoring Instrument	PIDMinPPB	Below the Detection Limit of the Monitoring Instrument
Temp Avg	22.2 °C	Temp Max Time	3/8/2022 1:58:51 PM
Temp Min Time	3/8/2022 8:15:59 AM	Temperature Max	23.1 °C
Temperature Min	19.4 °C		
Dust Impactor Setting	2.5 µm		

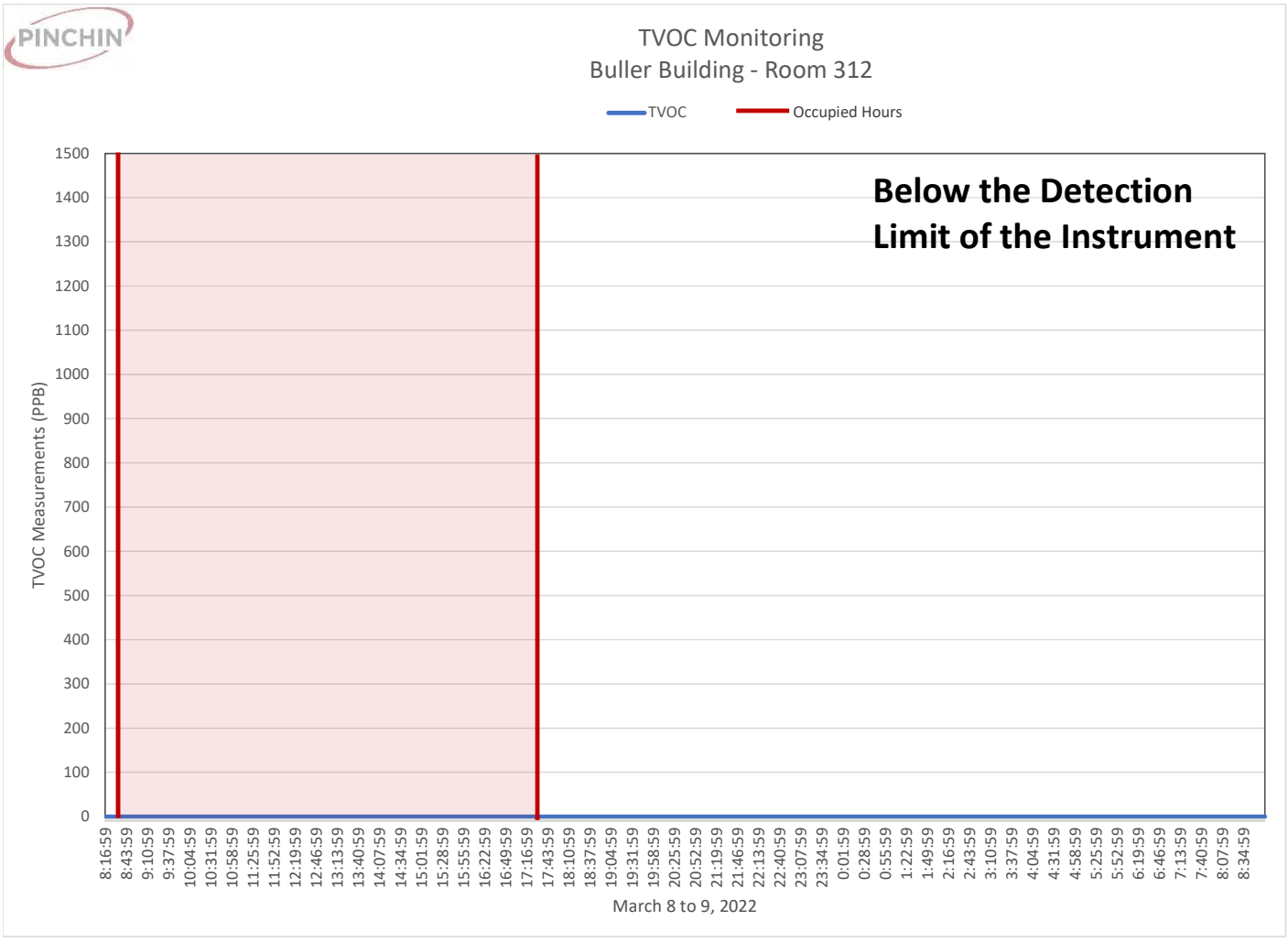

PINCHIN
Carbon Dioxide Monitoring
Buller Building - Room 312
Carbon Dioxide
Occupied Hours
Carbon Dioxide Measurements (ppm)
1500.00
1400.00
1300.00
1200.00
1100.00
1000.00
900.00
800.00
700.00
600.00
500.00
400.00
300.00
200.00
100.00
0.00
8:16:59
8:44:59
9:12:59
9:40:59
10:08:59
10:36:59
11:04:59
11:32:59
12:00:59
12:28:59
12:56:59
13:24:59
13:52:59
14:20:59
14:48:59
15:16:59
15:44:59
16:12:59
16:40:59
17:08:59
17:36:59
18:04:59
18:32:59
19:00:59
19:28:59
19:56:59
20:24:59
20:52:59
21:20:59
21:48:59
22:16:59
22:44:59
23:12:59
23:40:59
0:08:59
0:36:59
1:04:59
1:32:59
2:00:59
2:28:59
2:56:59
3:24:59
3:52:59
4:20:59
4:48:59
5:16:59
5:44:59
6:12:59
6:40:59
7:08:59
7:36:59
8:04:59
8:32:59
March 8 to 9, 2022


PINCHIN
Carbon Monoxide Monitoring
Buller Building - Room 312
Carbon Monoxide
Occupied Hours
Below the Detection Limit of the Instrument
Carbon Monoxide Measurements (ppm)
25.00
24.00
23.00
22.00
21.00
20.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
8:16:59
8:43:59
9:10:59
9:37:59
10:04:59
10:31:59
10:58:59
11:25:59
11:52:59
12:19:59
12:46:59
13:13:59
13:40:59
14:07:59
14:34:59
15:01:59
15:28:59
15:55:59
16:22:59
16:49:59
17:16:59
17:43:59
18:10:59
18:37:59
19:04:59
19:31:59
19:58:59
20:25:59
20:52:59
21:19:59
21:46:59
22:13:59
22:40:59
23:07:59
23:34:59
0:01:59
0:28:59
0:55:59
1:22:59
1:49:59
2:16:59
2:43:59
3:10:59
3:37:59
4:04:59
4:31:59
4:58:59
5:25:59
5:52:59
6:19:59
6:46:59
7:13:59
7:40:59
8:07:59
8:34:59
March 8 to 9, 2022


PINCHIN
Temperature Monitoring
Buller Building - Room 312
Temperature
Occupied Hours
Temperature Measurements (°C)
50.00
47.50
45.00
42.50
40.00
37.50
35.00
32.50
30.00
27.50
25.00
22.50
20.00
17.50
15.00
12.50
10.00
7.50
5.00
2.50
0.00
8:16:59
8:43:59
9:10:59
9:37:59
10:04:59
10:31:59
10:58:59
11:25:59
11:52:59
12:19:59
12:46:59
13:13:59
13:40:59
14:07:59
14:34:59
15:01:59
15:28:59
15:55:59
16:22:59
16:49:59
17:16:59
17:43:59
18:10:59
18:37:59
19:04:59
19:31:59
19:58:59
20:25:59
20:52:59
21:19:59
21:46:59
22:13:59
22:40:59
23:07:59
23:34:59
0:01:59
0:28:59
0:55:59
1:22:59
1:49:59
2:16:59
2:43:59
3:10:59
3:37:59
4:04:59
4:31:59
4:58:59
5:25:59
5:52:59
6:19:59
6:46:59
7:13:59
7:40:59
8:07:59
8:34:59
March 8 to 9, 2022


PINCHIN
Relative Humidity Monitoring
Buller Building - Room 312
%RH
Occupied Hours
Relative Humidty Measurements (%RH)
100.00
95.00
90.00
85.00
80.00
75.00
70.00
65.00
60.00
55.00
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
8:16:59
8:43:59
9:10:59
9:37:59
10:04:59
10:31:59
10:58:59
11:25:59
11:52:59
12:19:59
12:46:59
13:13:59
13:40:59
14:07:59
14:34:59
15:01:59
15:28:59
15:55:59
16:22:59
16:49:59
17:16:59
17:43:59
18:10:59
18:37:59
19:04:59
19:31:59
19:58:59
20:25:59
20:52:59
21:19:59
21:46:59
22:13:59
22:40:59
23:07:59
23:34:59
0:01:59
0:28:59
0:55:59
1:22:59
1:49:59
2:16:59
2:43:59
3:10:59
3:37:59
4:04:59
4:31:59
4:58:59
5:25:59
5:52:59
6:19:59
6:46:59
7:13:59
7:40:59
8:07:59
8:34:59
March 8 to 9, 2022


PINCHIN
Airborne Dust (PM 2.5) Monitoring
Buller Building - Room 312
PM2.5
Occupied Hours
PM 2.5 Measurements (µg/m³)
25.00
24.00
23.00
22.00
21.00
20.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
8:16:59
8:43:59
9:10:59
9:37:59
10:04:59
10:31:59
10:58:59
11:25:59
11:52:59
12:19:59
12:46:59
13:13:59
13:40:59
14:07:59
14:34:59
15:01:59
15:28:59
15:55:59
16:22:59
16:49:59
17:16:59
17:43:59
18:10:59
18:37:59
19:04:59
19:31:59
19:58:59
20:25:59
20:52:59
21:19:59
21:46:59
22:13:59
22:40:59
23:07:59
23:34:59
0:01:59
0:28:59
0:55:59
1:22:59
1:49:59
2:16:59
2:43:59
3:10:59
3:37:59
4:04:59
4:31:59
4:58:59
5:25:59
5:52:59
6:19:59
6:46:59
7:13:59
7:40:59
8:07:59
8:34:59
March 8 to 9, 2022


PINCHIN
TVOC Monitoring
Buller Building - Room 312
TVOC
Occupied Hours
Below the Detection Limit of the Instrument
TVOC Measurements (PPB)
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
8:16:59
8:43:59
9:10:59
9:37:59
10:04:59
10:31:59
10:58:59
11:25:59
11:52:59
12:19:59
12:46:59
13:13:59
13:40:59
14:07:59
14:34:59
15:01:59
15:28:59
15:55:59
16:22:59
16:49:59
17:16:59
17:43:59
18:10:59
18:37:59
19:04:59
19:31:59
19:58:59
20:25:59
20:52:59
21:19:59
21:46:59
22:13:59
22:40:59
23:07:59
23:34:59
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0:28:59
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1:49:59
2:16:59
2:43:59
3:10:59
3:37:59
4:04:59
4:31:59
4:58:59
5:25:59
5:52:59
6:19:59
6:46:59
7:13:59
7:40:59
8:07:59
8:34:59
March 8 to 9, 2022

FINAL

Investigation of Indoor Air Quality

Drake Centre
181 Freedman Crescent, Winnipeg, Manitoba

Prepared for:

University of Manitoba
120 Physical Plant,
89 Freedman Crescent
Winnipeg, Manitoba R3T 2N2

April 4, 2022

Pinchin File: 306866

Issued to: **University of Manitoba**
Issued on: **April 4, 2022**
Pinchin File: **306866**
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EXECUTIVE SUMMARY

Pinchin Ltd. (Pinchin) was retained by University of Manitoba (the Client) to conduct an investigation of indoor air quality (IAQ) that included 24-hour monitoring. The work was conducted at 181 Freedman Crescent, Winnipeg, Manitoba. Room 115 of the Drake Centre was the data logging location chosen by the client as it was occupied by staff and students during the hours of 08:30 - 11:45 and 18:15 - 21:30. Room 115 is located on the 100 Level of the Drake Centre at the Fort Garry campus. The client also requested that in locations where the 24-hour monitoring occurred, observations be made specifically to the cleanliness of supply air diffusers and return air grilles. As this is a follow up to the September 30, 2021, assessment, a re-inspection of the Heating Ventilation Air Conditioning (HVAC) system was not performed.

The majority of the indoor air quality measurements collected were within recommended ranges and should satisfy the majority of occupants. Carbon dioxide concentrations suggested adequate ventilation. Carbon monoxide concentrations did not suggest the presence of exhaust or combustion gases. Temperature measurements were within the recommended comfort ranges for office environments. $PM_{2.5}$ concentrations were within typical ranges. The Pinchin inspector did not identify any deficiencies with regards to unusual odours during the investigation.

Relative humidity measurements were below the recommended comfort range which may result in dry skin, eye and nose irritation. However, it should be noted that low relative humidity is a common wintertime condition in Canada.

The following recommendations are offered to improve air quality in this building:

1. Communicate the findings of this report to the staff, and health and safety representative; and
2. Review the humidification system in the building to ensure it is operational and functioning properly. Consider making adjustments as necessary.

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1.0 INTRODUCTION AND SCOPE

1.1 Statement of Understanding

Pinchin Ltd. (Pinchin) was retained by University of Manitoba (the Client) to conduct an investigation of Indoor Air Quality (IAQ) that included 24-hour monitoring. The work was conducted at 181 Freedman Crescent, Winnipeg, Manitoba. Room 115 of the Drake Centre was the data logging location chosen by the client as it was fully occupied by staff and students throughout the daytime hours. Room 115 is located on the 100 Level of the Drake Centre at the Fort Garry campus. The client also requested that in locations where the 24-hour monitoring occurred, observations be made specifically to the cleanliness of supply air diffusers and return air grilles. As this is a follow up to the September 30, 2021 assessment, a re-inspection of the Heating Ventilation Air Conditioning (HVAC) system was not performed.

1.2 Scope of Work

Pinchin performed the investigation on March 8 to March 9, 2022. The scope of this investigation was limited to Room 115.

The investigation involved the following activities:

- Review site via in-person walkthrough for factors that could contribute to poor indoor air quality; and
- Data-logging of Carbon Dioxide (CO_2), Carbon Monoxide (CO), Temperature (Temp), Relative Humidity (RH), Total Volatile Organic Compounds (TVOCs) and Particulate Matter smaller than 2.5 micrometres ($PM_{2.5}$) within Room 115.

2.0 METHODOLOGY

2.1 Interviews and Site Reviews

Pinchin interviewed the University of Manitoba Physical Plant, Project and Building Managers to discuss the history of the building, maintenance practices and any indoor air quality concerns.

The investigator did not perform any destructive work to inspect concealed conditions inside wall and/or ceiling cavities.

2.2 Test Methods and Criteria

The following table presents the parameters measured in this investigation, the instruments and sampling/analytical methods used, the applicable units of measurement, and the Indoor Air Quality criteria used for the evaluation of the results.

Table I – IAQ Parameters Tested, Measurement Criteria and Instruments

Parameter	Unit of Measurement	Recommended Limit	Instrumentation
Carbon dioxide, CO_2	Parts per million in air (ppm)	Outdoor Air (ppm) + 700 ppm [1]	24 hour Data-log Monitoring using a 3M® EVM-7 Air Quality Monitor
Carbon monoxide, CO	ppm	5 ppm [2]	
Temperature, T	°C	21 to 25°C, winter clothing [3]	
Relative Humidity, RH	% RH	25[4] to 65%[5], for occupant comfort	
Total Volatile Organic Compounds, (TVOC)	Parts per billion (ppb)	400 ppb[6]	
Particulate Matter smaller than 2.5 micrometres, $PM_{2.5}$	µg/m³	25 µg/m³ [7]24-hour mean;	24 hour Data-log Monitoring using an EVM-7 Air Quality Monitor

All data-logging direct-reading instruments were calibrated before use.

3.0 FINDINGS

3.1 Results of Interviews

Project or Building Manager reported the following:

- Air Handling Units (AHU) filters are changed every three months or as needed;
- The occupant capacity within Room is 58 people; and
- The enrollment/class ranges from 25 to 35 people.

1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Ventilation for Acceptable Indoor Air Quality* [ANSI/ASHRAE Standard 62.1-2019]. Atlanta, GA: ASHRAE, 2019.
2 Health Canada: *Indoor Air Quality in Office Buildings: A Technical Guide*. Ottawa, ON: Health Canada, 1995.
3 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Thermal Environmental Conditions for Human Occupancy* [ANSI/ASHRAE Standard 55-2020]. Atlanta, GA: ASHRAE, 2020.
4 L.E. Burton, J.G. Girman, S.E. Womble: Airborne particulate matter within 100 randomly selected office buildings in the United States (BASE). Proceedings of Healthy Buildings 2000, Vol. 1 (2001).
5 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Thermal Environmental Conditions for Human Occupancy* [ANSI/ASHRAE Standard 55-2020]. Atlanta, GA:ASHRAE, 2020.
6 Value calculated from: US Environmental Protection Agency (EPA) "Building Assessment Survey and Evaluation (BASE) Study [Online] Available at http://www.epa.gov/iaq/base/summarized_data.html#Volatile_Organic_Compounds (Accessed August 25, 2014).
7 W. Team, "WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide : global update 2005 : summary of risk assessment", Apps.who.int, 2021. [Online]. Available: http://apps.who.int/iris/handle/10665/69477. [Accessed: 15-Sep- 2021].

3.2 Facility Description

Table II – Facility Description

Item	Details
Construction Date	1987
Number of Floors	Six floors above grade, one floor below grade
Structural Type	Steel
Foundation Type	Concrete
Exterior Cladding	Brick
HVAC	Forced air
Roof	Built up
Flooring	Carpet, ceramic tile
Interior Walls	Drywall
Ceilings	Acoustic ceiling tile

3.3 Results of Site Reviews

Appendix I presents the drawing.

During the investigation Pinchin noted the supply diffusers were clear from any obstructions, and were observed clean (Photo #1)

Refer to Table III for photographs from the investigation.

Table III – Photographs from Investigation

Photo 1 - Room 115 Supply diffuser

3.4 Results of Indoor Air Quality Tests

Appendix II presents the results of data-logging for IAQ parameters.

The EVM 7 air monitor was used for 24-hour monitoring within Room 115, of $PM_{2.5}$, CO_2, CO, TVOC, Temperature, and Relative Humidity. The EVM-7 is a direct-reading instrument and were calibrated before use.

3.4.1 Carbon Dioxide (CO_2)

The 24-hour minimum CO_2 concentration recorded within the building was 360 ppm, the maximum CO_2 concentration was 451 ppm. The 24-hour average for CO_2 was 384 ppm. The average CO_2 concentration during **the occupied time** was 382 ppm. On March 8 and March 9 outdoor spot measurements were recorded. The average outdoor CO2 spot measurements for the two days was 445 ppm. The carbon dioxide concentrations were below the limit of 1,145 ppm (445 ppm outdoors plus 700 ppm) recommended by American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) to provide indoor air quality acceptable to the majority of occupants. This indicates that the volume of the supply air was adequate for the occupancy loading at the time of the investigation.

3.4.2 Carbon Monoxide (CO)

The carbon monoxide concentrations were non-detectable or just at the detection limit of the instrumentation for the duration of the 24-hour monitoring. Health Canada advises that the detection of carbon monoxide above 5 ppm indicates a concern requiring further investigation.

3.4.3 Temperature (Temp)

The 24-hour minimum temperature measurement was 20.6 °C, the maximum temperature measurement was 25.2 °C. The 24-hour average temperature measurement was 24.6 °C. The average temperature measurement during **the occupied time** was 24.6 °C. On March 8 and March 9 outdoor spot measurements were taken each day, averaging -13.5 °C for these dates. The indoor temperatures were within the recommended comfort ranges for office environments for typical dress during winter conditions, of 21 to 25 °C.

3.4.4 Relative Humidity (RH)

The 24-hour minimum Relative Humidity measurement was 7.2 %RH, the maximum measurement was 19.7 %RH. The 24-hour average measurement for relative humidity was 10.8 %RH. The average relative humidity measurement during **the occupied time** was 12.1 %RH. On March 8 and March 9 outdoor spot measurements were taken each day, averaging 75.5 %RH for these dates. Relative humidity below 25 %RH may result in complaints of dry skin and eye and nose irritation. Low relative humidity is a common winter time condition in Canada due to difficulties with humidification.

3.4.5 Particulate Matter ($PM_{2.5}$)

The 24-hour minimum concentration for $PM_{2.5}$ was below the detection limit of the monitoring instrument, the maximum concentration for $PM_{2.5}$ was 59 µg/m³. The 24-hour average concentration for $PM_{2.5}$ was 1 µg/m³. The average $PM_{2.5}$ concentrations during **the occupied time** was 0.7 µg/m³, On March 8 and March 9 outdoor spot measurements were taken each day, averaging 5 µg/m³ for these dates. For reference, World Health Organization (WHO) provides a guideline of 25 µg/m³ over a 24-hour period. The $PM_{2.5}$ concentrations in this building fell within the range typically measured in commercial buildings.

3.4.6 Total Volatile Organic Compounds (TVOC)

The TVOC concentrations were non-detectable or just at the detection limit of the instrumentation for the duration of the 24-hour monitoring. Based on US EPA research, office environments with TVOC concentrations up to 400 ppb would be at little risk of IAQ concern. As this is a guideline, complaints might be expected if concentrations were significantly above 400 ppb.

Table IV – Summary of 24-Hour Data-logging IAQ based on Indoor Air Quality Measurement Criteria

Parameter	Measurement Average	Indoor Air Quality Measurement Criteria	Below Indoor Air Quality Measurement Criteria?
Carbon Dioxide	384 ppm	Outdoor Air (ppm) + 700 ppm	Yes
Carbon Monoxide	0 ppm	5ppm	Yes
Temperature (°C)	24.6 °C	21 to 25 °C, winter clothing	Yes
Relative Humidity (%)	10.8 %	25 to 65 %, for occupant comfort	No
$PM_{2.5}$	1 µg/m³	25 µg/m³	Yes
TVOC	**Below the Detection Limit of the Monitoring Instrument**	400 ppb	Yes

4.0 DISCUSSION

The majority of the indoor air quality measurements collected were within recommended ranges and meet the criteria of the guidelines referenced. Carbon dioxide concentrations suggested adequate ventilation. Carbon monoxide concentrations did not suggest the presence of exhaust or combustion gases. Temperature measurements were within the recommended comfort ranges for office environments. $PM_{2.5}$ concentrations were within typical ranges. Total Volatile Organic Compound (TVOC) concentrations were within the recommended range The Pinchin inspector did not identify any deficiencies with regards to unusual odours during the investigation.

Relative Humidity measurements were below the recommended comfort range which may result in dry skin, eye and nose irritation. However, it should be noted that low relative humidity is a common wintertime condition in Canada.

5.0 RECOMMENDATIONS

Pinchin offers the following recommendations to improve air quality in this building:

1. Communicate the findings of this report to the staff, and health and safety representitive; and
2. Review the humidification system in the building to ensure it is operational and functioning properly. Consider making adjustments as necessary.

6.0 TERMS AND LIMITATIONS

This work was performed subject to the Terms and Limitations presented or referenced in the proposal for this project.

Information provided by Pinchin is intended for Client use only. Pinchin will not provide results or information to any party unless disclosure by Pinchin is required by law. Any use by a third party of reports or documents authored by Pinchin or any reliance by a third party on or decisions made by a third party based on the findings described in said documents, is the sole responsibility of such third parties. Pinchin accepts no responsibility for damages suffered by any third party as a result of decisions made or actions conducted. No other warranties are implied or expressed.

APPENDIX I

Drawings

N

LEGEND

DATA LOGGING LOCATION

BASE PLAN PROVIDED BY CLIENT.

PINCHIN

PROJECT NAME:
INDOOR AIR QUALITY ASSESSMENT

CLIENT NAME:
UNIVERSITY OF MANITOBA DRAKE

PROJECT LOCATION:
181 FREEDMAN CRESCENT WINNIPEG, MANITOBA

FIGURE NAME:
LEVEL 100

PROJECT NUMBER:	SCALE:
306866	NOT TO SCALE
DRAWN BY:	REVIEWED BY:
CE	JB
DATE:	FIGURE NUMBER:
2022/03/17	1 OF 1

APPENDIX II

Results of Data-Logging Indoor Air Quality Measurements

Session Report
181 Freedman Crescent
Drake Building

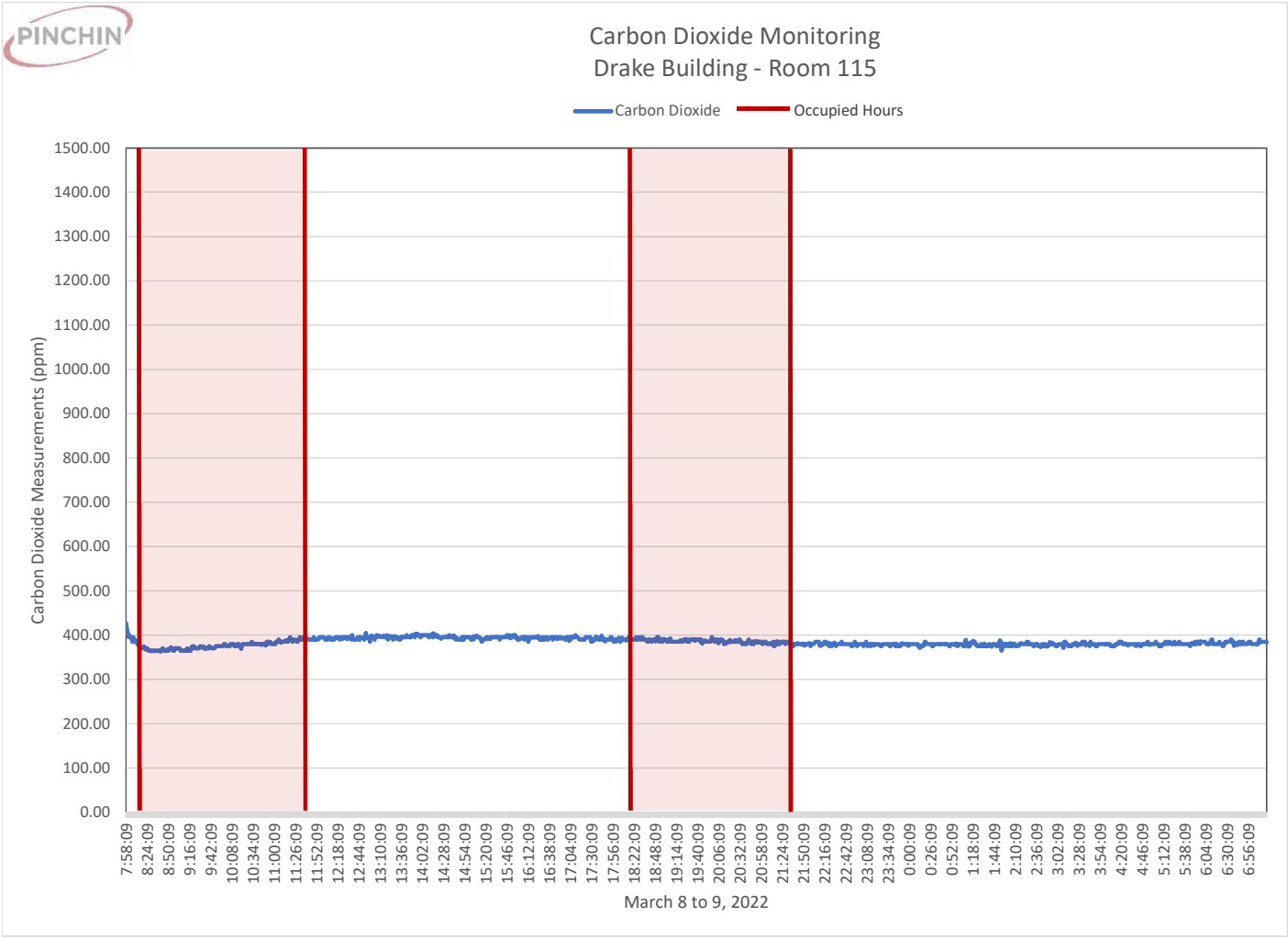
3/8/2022

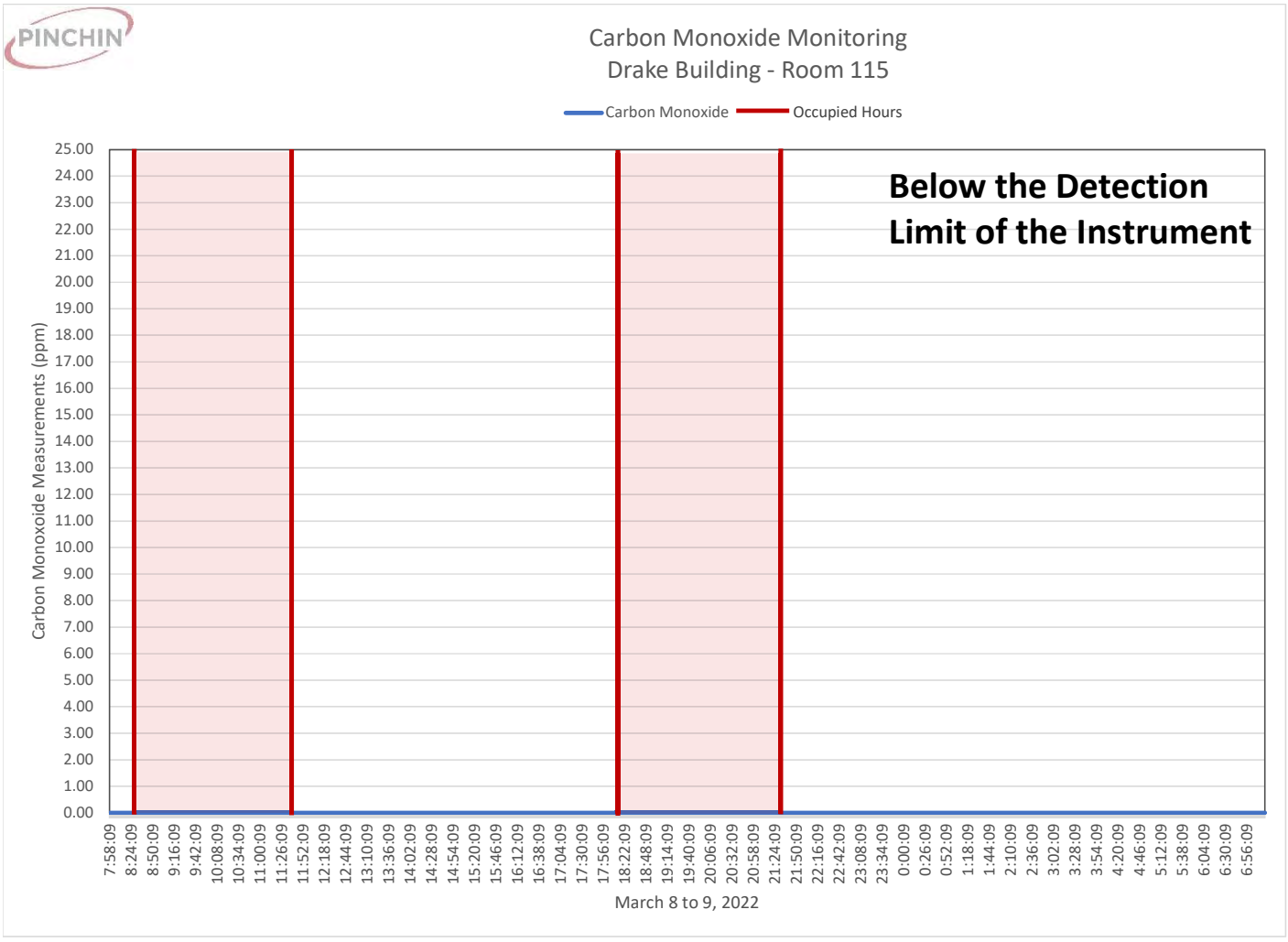
Datalog Period

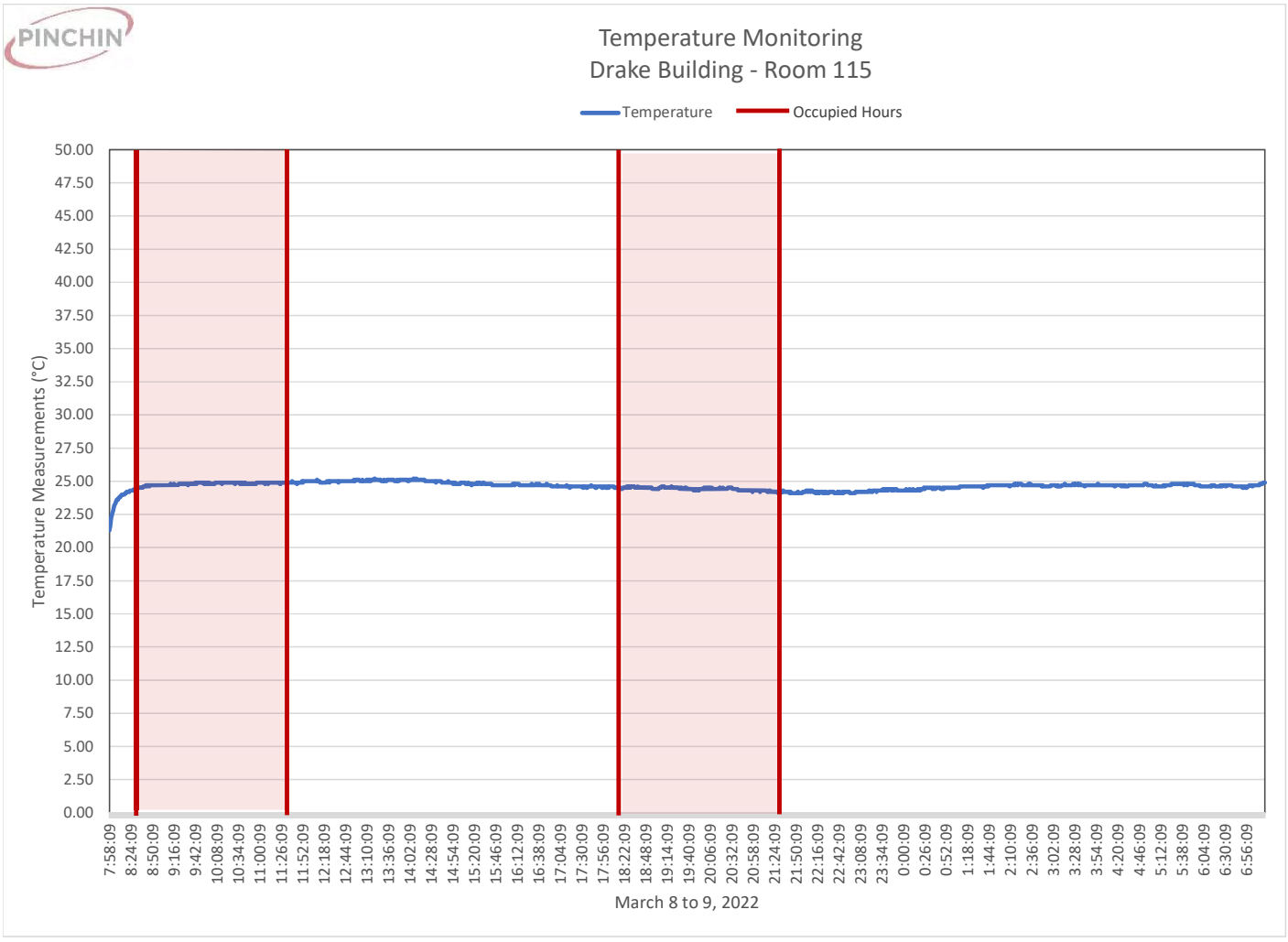
Device Name	EMM120003
Serial Number	EMM120003
Run Time	23:19:16
Start Time	3/8/2022 7:57:09 AM
Stop Time	3/9/2022 7:16:25 AM

IAQ Data Summary

Description	Value	Description	Value
CO2Ave	384 PPM	CO2Max	451 PPM
CO2MaxTime	3/8/2022 7:57:32 AM	CO2Min	360 PPM
COAve	0 PPM	COMax	0 PPM
COMin	0 PPM	Dust Average	1.000 ug/m³
Dust Max	59.000 ug/m³	Dust Min	0.000 ug/m³
Humidity Avg	10.8 %	Humidity Max	19.7 %
Humidity Max Time	3/8/2022 7:57:19 AM	Humidity Min	7.2 %
Humidity Min Time	3/9/2022 7:14:05 AM	PIDAvePPB	Below the Detection Limit of the Monitoring Instrument
PIDMaxPPB	Below the Detection Limit of the Monitoring Instrument	PIDMinPPB	Below the Detection Limit of the Monitoring Instrument
Temp Avg	24.6 °C	Temp Max Time	3/8/2022 2:07:01 PM
Temp Min Time	3/8/2022 7:57:09 AM	Temperature Max	25.2 °C
Temperature Min	20.6 °C		
Dust Impactor Setting	2.5 µm		


PINCHIN
Carbon Dioxide Monitoring
Drake Building - Room 115
Carbon Dioxide
Occupied Hours
Carbon Dioxide Measurements (ppm)
1500.00
1400.00
1300.00
1200.00
1100.00
1000.00
900.00
800.00
700.00
600.00
500.00
400.00
300.00
200.00
100.00
0.00
7:58:09
8:24:09
8:50:09
9:16:09
9:42:09
10:08:09
10:34:09
11:00:09
11:26:09
11:52:09
12:18:09
12:44:09
13:10:09
13:36:09
14:02:09
14:28:09
14:54:09
15:20:09
15:46:09
16:12:09
16:38:09
17:04:09
17:30:09
17:56:09
18:22:09
18:48:09
19:14:09
19:40:09
20:06:09
20:32:09
20:58:09
21:24:09
21:50:09
22:16:09
22:42:09
23:08:09
23:34:09
0:00:09
0:26:09
0:52:09
1:18:09
1:44:09
2:10:09
2:36:09
3:02:09
3:28:09
3:54:09
4:20:09
4:46:09
5:12:09
5:38:09
6:04:09
6:30:09
6:56:09
March 8 to 9, 2022


PINCHIN
Carbon Monoxide Monitoring
Drake Building - Room 115
Carbon Monoxide
Occupied Hours
Below the Detection Limit of the Instrument
Carbon Monoxide Measurements (ppm)
25.00
24.00
23.00
22.00
21.00
20.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
7:58:09
8:24:09
8:50:09
9:16:09
9:42:09
10:08:09
10:34:09
11:00:09
11:26:09
11:52:09
12:18:09
12:44:09
13:10:09
13:36:09
14:02:09
14:28:09
14:54:09
15:20:09
15:46:09
16:12:09
16:38:09
17:04:09
17:30:09
17:56:09
18:22:09
18:48:09
19:14:09
19:40:09
20:06:09
20:32:09
20:58:09
21:24:09
21:50:09
22:16:09
22:42:09
23:08:09
23:34:09
0:00:09
0:26:09
0:52:09
1:18:09
1:44:09
2:10:09
2:36:09
3:02:09
3:28:09
3:54:09
4:20:09
4:46:09
5:12:09
5:38:09
6:04:09
6:30:09
6:56:09
March 8 to 9, 2022


PINCHIN
Temperature Monitoring
Drake Building - Room 115
Temperature
Occupied Hours
Temperature Measurements (°C)
50.00
47.50
45.00
42.50
40.00
37.50
35.00
32.50
30.00
27.50
25.00
22.50
20.00
17.50
15.00
12.50
10.00
7.50
5.00
2.50
0.00
7:58:09
8:24:09
8:50:09
9:16:09
9:42:09
10:08:09
10:34:09
11:00:09
11:26:09
11:52:09
12:18:09
12:44:09
13:10:09
13:36:09
14:02:09
14:28:09
14:54:09
15:20:09
15:46:09
16:12:09
16:38:09
17:04:09
17:30:09
17:56:09
18:22:09
18:48:09
19:14:09
19:40:09
20:06:09
20:32:09
20:58:09
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23:08:09
23:34:09
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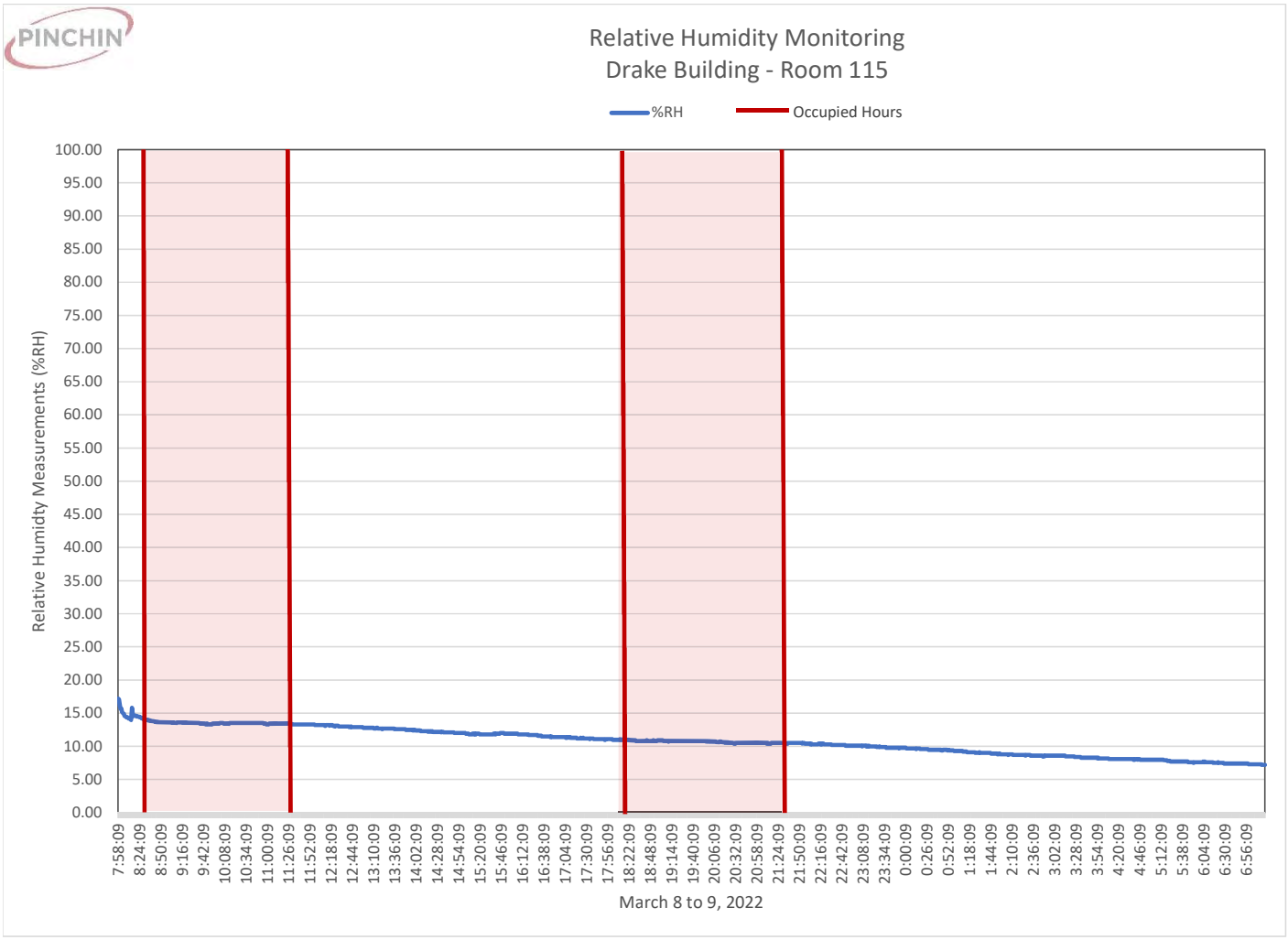
0:26:09
0:52:09
1:18:09
1:44:09
2:10:09
2:36:09
3:02:09
3:28:09
3:54:09
4:20:09
4:46:09
5:12:09
5:38:09
6:04:09
6:30:09
6:56:09
March 8 to 9, 2022


PINCHIN
Relative Humidity Monitoring
Drake Building - Room 115
%RH
Occupied Hours
Relative Humidty Measurements (%RH)
100.00
95.00
90.00
85.00
80.00
75.00
70.00
65.00
60.00
55.00
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
7:58:09
8:24:09
8:50:09
9:16:09
9:42:09
10:08:09
10:34:09
11:00:09
11:26:09
11:52:09
12:18:09
12:44:09
13:10:09
13:36:09
14:02:09
14:28:09
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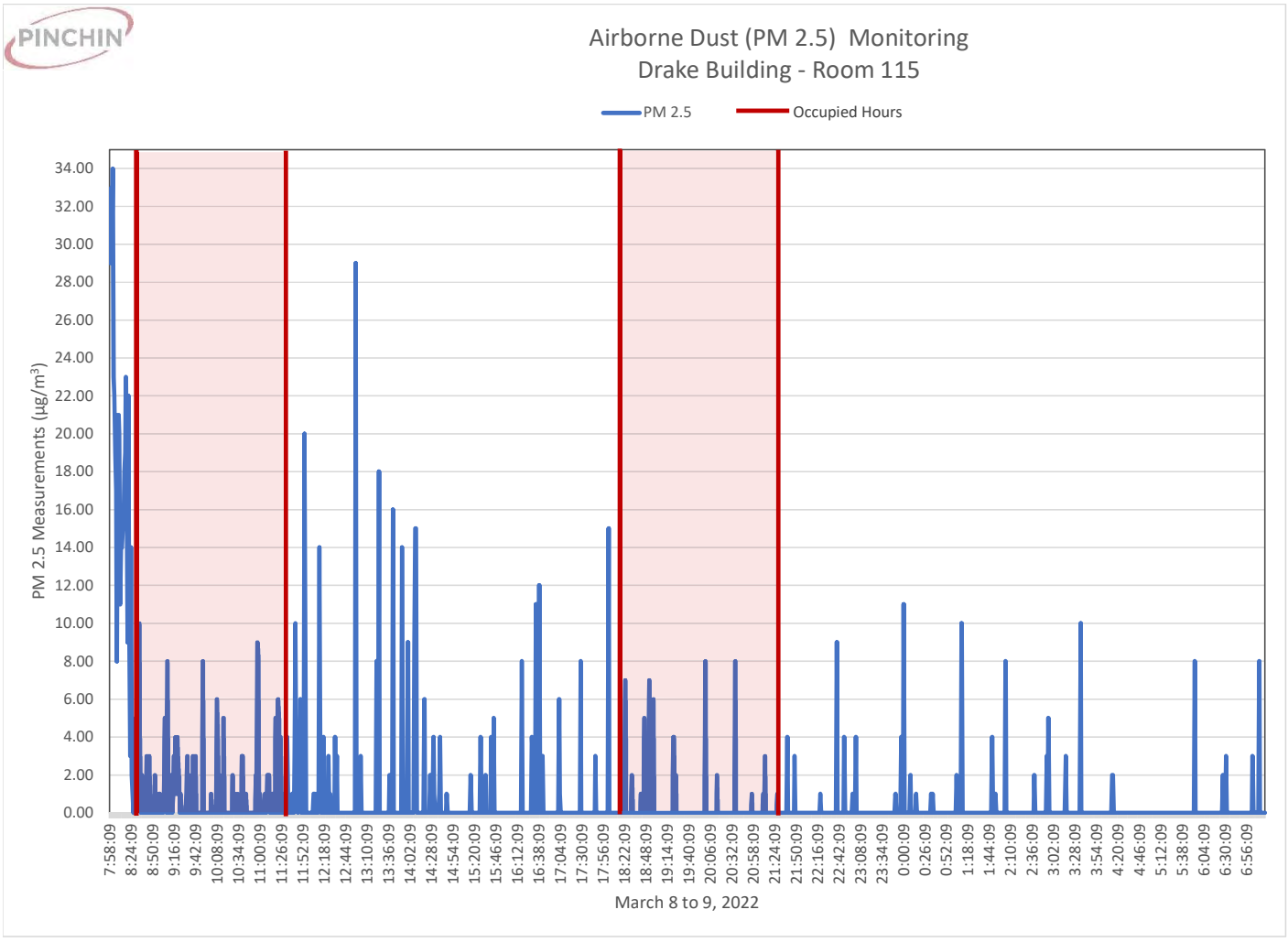
15:46:09
16:12:09
16:38:09
17:04:09
17:30:09
17:56:09
18:22:09
18:48:09
19:14:09
19:40:09
20:06:09
20:32:09
20:58:09
21:24:09
21:50:09
22:16:09
22:42:09
23:08:09
23:34:09
0:00:09
0:26:09
0:52:09
1:18:09
1:44:09
2:10:09
2:36:09
3:02:09
3:28:09
3:54:09
4:20:09
4:46:09
5:12:09
5:38:09
6:04:09
6:30:09
6:56:09
March 8 to 9, 2022


PINCHIN
Airborne Dust (PM 2.5) Monitoring
Drake Building - Room 115
PM 2.5
Occupied Hours
PM 2.5 Measurements (µg/m³)
34.00
32.00
30.00
28.00
26.00
24.00
22.00
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
7:58:09
8:24:09
8:50:09
9:16:09
9:42:09
10:08:09
10:34:09
11:00:09
11:26:09
11:52:09
12:18:09
12:44:09
13:10:09
13:36:09
14:02:09
14:28:09
14:54:09
15:20:09
15:46:09
16:12:09
16:38:09
17:04:09
17:30:09
17:56:09
18:22:09
18:48:09
19:14:09
19:40:09
20:06:09
20:32:09
20:58:09
21:24:09
21:50:09
22:16:09
22:42:09
23:08:09
23:34:09
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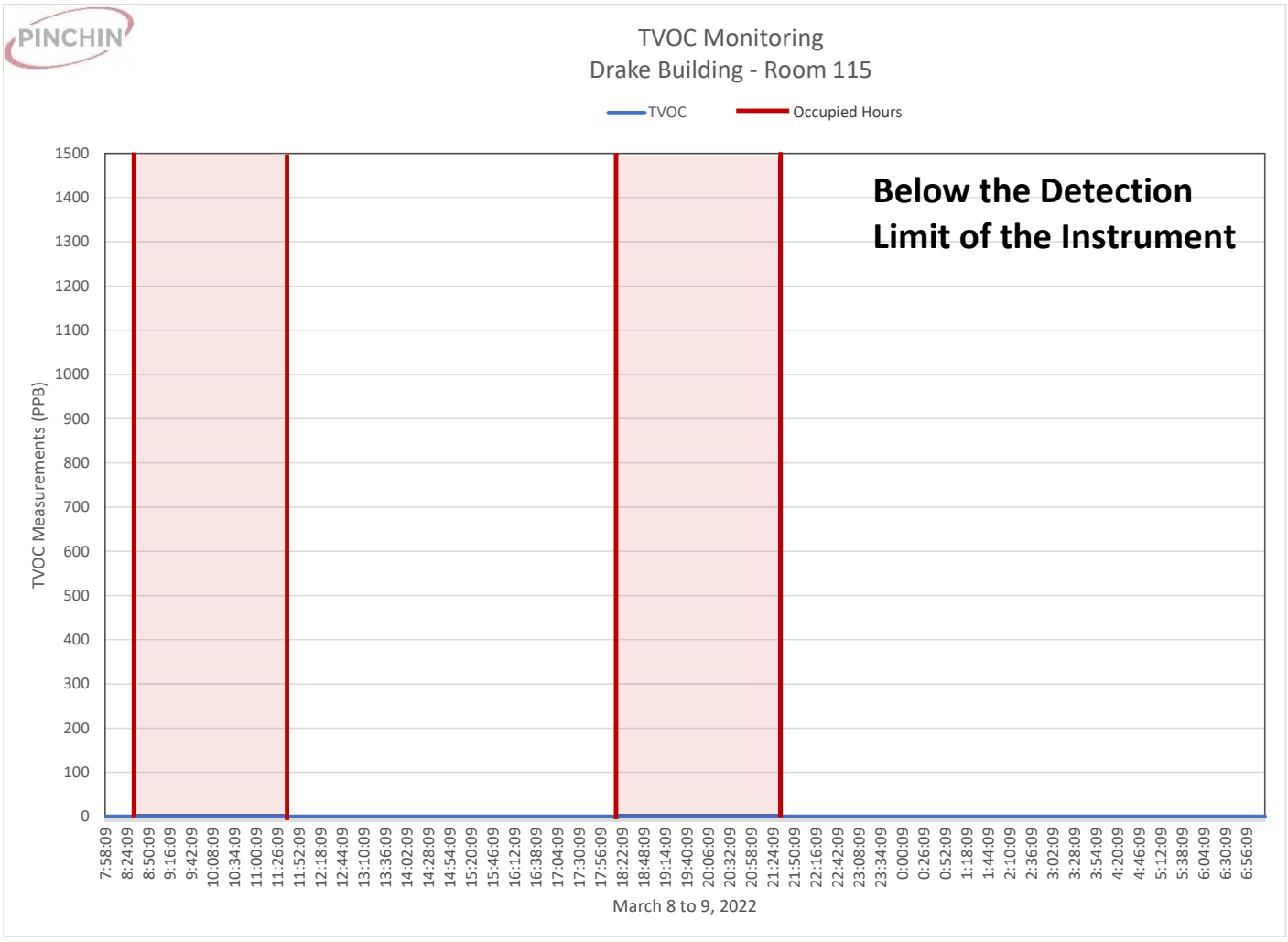
0:26:09
0:52:09
1:18:09
1:44:09
2:10:09
2:36:09
3:02:09
3:28:09
3:54:09
4:20:09
4:46:09
5:12:09
5:38:09
6:04:09
6:30:09
6:56:09
March 8 to 9, 2022


PINCHIN
TVOC Monitoring
Drake Building - Room 115
TVOC
Occupied Hours
Below the Detection Limit of the Instrument
TVOC Measurements (PPB)
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
7:58:09
8:24:09
8:50:09
9:16:09
9:42:09
10:08:09
10:34:09
11:00:09
11:26:09
11:52:09
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15:46:09
16:12:09
16:38:09
17:04:09
17:30:09
17:56:09
18:22:09
18:48:09
19:14:09
19:40:09
20:06:09
20:32:09
20:58:09
21:24:09
21:50:09
22:16:09
22:42:09
23:08:09
23:34:09
0:00:09
0:26:09
0:52:09
1:18:09
1:44:09
2:10:09
2:36:09
3:02:09
3:28:09
3:54:09
4:20:09
4:46:09
5:12:09
5:38:09
6:04:09
6:30:09
6:56:09
March 8 to 9, 2022

FINAL

Investigation of Indoor Air Quality

EITC-2

75 Chancellors Circle, Winnipeg, Manitoba

Prepared for:

University of Manitoba
120 Physical Plant,
89 Freedman Crescent
Winnipeg, Manitoba, R3T 2N2

March 31, 2022

Pinchin File: 306866

Issued to: **University of Manitoba**
Issued on: **March 31, 2022**
Pinchin File: **306866**
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EXECUTIVE SUMMARY

Pinchin Ltd. (Pinchin) was retained by University of Manitoba (the Client) to conduct an investigation of indoor air quality (IAQ) that included 24-hour monitoring. The work was conducted at 75 Chancellors Circle, Winnipeg, Manitoba. Rooms 125 and 351 of the EITC-2 building were the data logging locations chosen by the client as they were to be fully occupied by staff and students during the hours of 8:30 am - 12:30 pm and 2:30 pm – 5:30 pm. Room 125 is located on Level 100, and Room 351 is located on Level 300 of the EITC-2 Building at the Fort Garry campus. The client also requested that in locations where the 24-hour monitoring occurred, observations be made specifically to the cleanliness of supply air diffusers and return air grilles. As this is a follow up to the October 5, 2021 assessment, a re- inspection of the Heating Ventilation Air Conditioning (HVAC) system was not performed.

The majority of the indoor air quality measurements collected were within recommended ranges and meet the criteria of the referenced guidelines. Carbon Dioxide concentrations suggested adequate ventilation. Carbon Monoxide concentrations did not suggest the presence of exhaust or combustion gases. Temperature measurements were within the recommended comfort ranges for office environments. Particulate Matter $PM_{2.5}$ concentrations were within typical ranges. The Pinchin inspector did not identify any deficiencies with regards to unusual odours during the investigation.

Relative Humidity measurements were below the recommended comfort range which may result in dry skin, eye and nose irritation. However, it should be noted that low relative humidity is a common wintertime condition in Canada.

The following recommendations are offered to improve air quality in this building:

1. Communicate the findings of this report to the staff, and health and safety representative; and
2. Review the humidification system in the building to ensure it is operational and functioning properly. Consider making adjustments as necessary.

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1.0 INTRODUCTION AND SCOPE

1.1 Statement of Understanding

Pinchin Ltd. (Pinchin) was retained by University of Manitoba (the Client) to conduct an investigation of indoor air quality (IAQ) that included 24-hour monitoring. The work was conducted at 75 Chancellors Circle, Winnipeg, Manitoba. Rooms 125 and 351 of the EITC-2 building were the data logging location chosen by the client as it was fully occupied by staff and students throughout the daytime hours. Room 125 is located on Level 100, and Room 351 is located on Level 300 of the EITC-2 Building at the Fort Garry campus. The client also requested that in locations where the 24-hour monitoring occurred, observations be made specifically to the cleanliness of supply air diffusers and return air grilles. As this is a follow up to the October 5, 2021 assessment, a re-inspection of the Heating Ventilation Air Conditioning (HVAC) system was not performed as this is a follow up investigation and the settings and system has not changed.

1.2 Scope of Work

Pinchin performed the investigation on March 8 to March 9, 2022. The scope of this investigation was limited to Rooms 125, and 351.

The investigation involved the following activities:

- Walkthrough site reviews for factors that could degrade air quality; and
- 24 Hour Data-logging of Carbon Dioxide (CO_2), Carbon Monoxide (CO), Temperature (Temp), Relative Humidity (RH), Total Volatile Organic Compounds (TVOCs) and Particulate Matter smaller than 2.5 micrometres ($PM_{2.5}$) within Rooms 125, and 351.

2.0 METHODOLOGY

2.1 Interviews and Site Reviews

Pinchin interviewed the University of Manitoba Physical Plant, Project and Building Managers to discuss the history of the building, maintenance practices and any indoor air quality concerns.

The investigator did not perform any destructive work to inspect concealed conditions inside wall and/or ceiling cavities.

2.2 Test Methods and Criteria

The following table presents the parameters measured in this investigation, the instruments and sampling/analytical methods used, the applicable units of measurement, and the Indoor Air Quality criteria used for the evaluation of the results.

Table I – IAQ Parameters Tested, Measurement Criteria and Instruments

Parameter	Unit of Measurement	Recommended Limit	Instrumentation
Carbon dioxide, CO_2	Parts per million in air (ppm)	Outdoor Air (ppm) + 700 ppm [1]	24 hour Data-log Monitoring using a 3M® EVM-7 Air Quality Monitor
Carbon monoxide, CO	ppm	5 ppm [2]	
Temperature, T	°C	21 to 25 °C, winter clothing [3]	
Relative Humidity, RH	%RH	25[4] to 65%[5], for occupant comfort	
Total Volatile Organic Compounds, (TVOC)	Parts per billion (ppb)	400 ppb[6]	
Particulate Matter smaller than 2.5 micrometres, $PM_{2.5}$	µg/m³	25 µg/m³ [7]24-hour mean;	

All data-logging direct-reading instruments were calibrated before use.

3.0 FINDINGS

3.1 Results of Interviews

Project or Building Manager reported the following:

- Air Handling Units (AHU) filters are changed every three months or as needed;
- Cleaners were observed within Room 125 as Pinchin arrived;
- Occupant capacity for Room 125 is 81 people, Room 351 is 40 people; and

1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Ventilation for Acceptable Indoor Air Quality* [ANSI/ASHRAE Standard 62.1-2019]. Atlanta, GA: ASHRAE, 2019.
2 Health Canada: *Indoor Air Quality in Office Buildings: A Technical Guide*. Ottawa, ON: Health Canada, 1995.
3 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Thermal Environmental Conditions for Human Occupancy* [ANSI/ASHRAE Standard 55-2020]. Atlanta, GA: ASHRAE, 2020.
4 L.E. Burton, J.G. Girman, S.E. Womble: Airborne particulate matter within 100 randomly selected office buildings in the United States (BASE). Proceedings of Healthy Buildings 2000, Vol. 1 (2001).
5 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Thermal Environmental Conditions for Human Occupancy* [ANSI/ASHRAE Standard 55-2020]. Atlanta, GA:ASHRAE, 2020.
6 Value calculated from: US Environmental Protection Agency (EPA) "Building Assessment Survey and Evaluation (BASE) Study [Online] Available at http://www.epa.gov/iaq/base/summarized_data.html#Volatile_Organic_Compounds (Accessed August 25, 2014).
7 W. Team, "WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide : global update 2005 : summary of risk assessment", Apps.who.int, 2021. [Online]. Available: http://apps.who.int/iris/handle/10665/69477. [Accessed: 15-Sep- 2021].

- The enrollment/class for Room 125 ranges from 20 to 68 people, Room 351 ranges from 17 to 40 people.

3.2 Facility Description

Table II – Facility Description

Item	Details
Construction Date	2013
Number of Floors	Five floors above grade, one floor below grade
Structural Type	Steel
Foundation Type	Concrete
Exterior Cladding	Brick
HVAC	Forced air
Roof	Built up
Flooring	Ceramic tile
Interior Walls	Drywall
Ceilings	Acoustic ceiling tile

3.3 Results of Site Reviews

Appendix I presents the drawings.

During the investigation Pinchin noted for both Room 125, and 351 the supply diffusers and return grilles were clear from any obstructions, and were observed clean (Photo #1-3)

Refer to Table III for photographs from the investigation.

Table III – Photographs from Investigation

Photo 1 - Supply diffuser Room 125

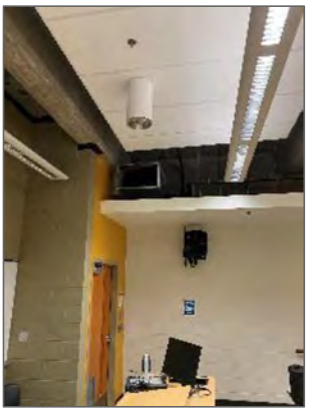


Photo 2 - EITC return duct Room 125

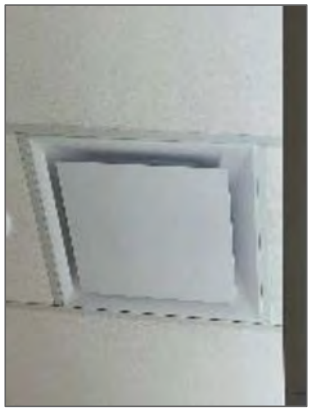


Photo 3 - Supply diffuser Room 351

3.4 Results of Indoor Air Quality Tests

Appendix II presents the results of data-logging for IAQ parameters.

The EVM 7 air monitor was used for 24-hour data logging within Rooms 125 and 351 of $PM_{2.5}$, CO_2, CO, TVOC, Temperature, and Relative Humidity. The EVM-7 is a direct-reading and datalogging instrument and was calibrated before use.

3.4.1 Carbon Dioxide (CO_2)

The 24-hour minimum CO_2 concentration recorded within Room 125 was 355 ppm, the maximum CO_2 concentration was 921 ppm. The 24- hour average for CO_2 was 472 ppm. The average CO_2 concentration during **the occupied time** was 697 ppm. On March 8 and March 9 outdoor spot measurements were recorded. The average outdoor CO2 spot measurements for the two days was 445 ppm. The indoor Carbon Dioxide concentrations were below the limit of 1,145 ppm (445 ppm outdoors plus 700 ppm) recommended by American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) to provide indoor air quality acceptable to the majority of occupants. This indicates that the supply of outdoor air was adequate for the occupancy loading at the time of the investigation.

The 24-hour minimum CO_2 concentration recorded within Room 351 was 418 ppm, the maximum CO_2 concentration was 3,064 ppm. The 24 hour average for CO_2 averaged 697. The average CO_2 concentration during **the occupied time** was 1,074 ppm. The indoor Carbon Dioxide concentrations were below the limit of 1,145 ppm (445 ppm outdoors plus 700 ppm) recommended by American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) to provide indoor air quality acceptable to the majority of occupants. This indicates that the supply of outdoor air was adequate for the occupancy loading at the time of the investigation. There was an elevated reading at one point during **the occupied time**, this is likely due to activities occurring around the EVM at that particular moment as readings stabilized shortly thereafter.

3.4.2 Carbon Monoxide (CO)

The 24-hour minimum CO concentration within Room 125 was below the detection limit of the instrumentation, the maximum CO concentration was 1 ppm. The 24-hour average for CO was 0.04 ppm. The average CO concentration during **the occupied time** was 0.11 ppm. On March 8 and March 9 outdoor spot measurements were recorded. The average outdoor CO spot measurements for the two days was below the detection limit of the instrumentation.

The carbon monoxide concentrations were non-detectable or just at the detection limit of the instrumentation for the duration of the 24-hour datalogging in Room 351. Health Canada advises that the detection of carbon monoxide above 5 ppm indicates a concern requiring further investigation.

3.4.3 Temperature (Temp)

The 24-hour minimum Temperature measurement for Room 125 was 20.8 °C, the maximum Temperature measurement was 23.4 °C. The 24-hour average for Temperature measurement in Room 125 was 22.8 °C. The average Temperature measurements during **the occupied time** in Room 125 was 22.8 °C, On March 8 and March 9 outdoor spot measurements were taken each day. The average outdoor Temperature spot measurements for the two days was -13.5 °C. The Temperatures were within the recommended comfort ranges for office environments for typical dress during winter conditions, of 21 to 25 °C

The 24-hour minimum Temperature measurement for Room 351 was 22.1 °C, the maximum Temperature measurement was 25.1 °C. The 24-hour average for Temperature in Room 351 was 23.5 °C. The average Temperature measurements during **the occupied time** in Room 351 was 23.8 °C. The temperatures were within the recommended comfort ranges for office environments for typical dress during winter conditions, of 21 to 25 °C.

3.4.4 Relative Humidity (RH)

The 24-hour minimum Relative Humidity measurement for Room 125 was 3.5 %RH, the maximum Relative Humidity measurement was 17.6 %RH. The 24-hour average measurement for Relative Humidity was 8.1 %RH. The average Relative Humidity measurements during **the occupied time** was 13.2 %RH. On March 9 and March 10 outdoor spot measurements were taken each day. The average outdoor Relative Humidity spot measurements for the two days was 75.5 %RH. Relative humidity below 25 %RH may result in complaints of dry skin and eye and nose irritation. Low relative humidity is a common winter time condition in Canada due to difficulties with humidification.

The 24-hour minimum Relative Humidity measurement for Room 351 was 3.5 %RH, the maximum Relative Humidity measurement was 17.6 %RH. The 24-hour average measurement for Relative Humidity averaged 11.6 %RH. The average Relative Humidity measurements during **the occupied time** was 14.9 %RH. Relative humidity below 25 %RH may result in complaints of dry skin and eye and nose irritation. Low relative humidity is a common winter time condition in Canada due to difficulties with humidification.

3.4.5 Particulate Matter ($PM_{2.5}$)

The 24-hour minimum concentration for $PM_{2.5}$ within Room 125 was below the detection limits of the monitoring instrument, the maximum concentration for $PM_{2.5}$ was 11 µg/m³. The 24-hour average concentration for $PM_{2.5}$ averaged 1 µg/m³. The average $PM_{2.5}$ concentrations during **the occupied time** was 2 µg/m³. On March 9 and March 10 outdoor spot measurements were taken each day. The average outdoor $PM_{2.5}$ spot measurements for the two days was 5 µg/m³ . For reference, World Health Organization (WHO) provides a guideline of 25 µg/m³ over a 24-hour period. The $PM_{2.5}$ concentrations in this building fell within the range typically measured in commercial buildings.

The 24-hour minimum concentration for $PM_{2.5}$ within Room 351 was below the detection limits of the monitoring instrument, the maximum concentration for $PM_{2.5}$ was 35 µg/m³. The 24-hour average concentration for $PM_{2.5}$ averaged 3.1 µg/m³. The average $PM_{2.5}$ concentrations during **the occupied time** was 5 µg/m³. For reference, World Health Organization (WHO) provides a guideline of 25 µg/m³ over a 24-hour period. The $PM_{2.5}$ concentrations in this building fell within the range typically measured in commercial buildings.

3.4.6 Total Volatile Organic Compounds (TVOC)

The 24-hour minimum concentrations for TVOC within Room 125 was below the detection limits of the monitoring instrument, the maximum was 4,400 ppb. During set up of the monitors a caretaker was wiping down desktops in the sample location with a disinfectant. This is likely the cause of the TVOC spike. The 24-hour average for TVOCs was 235 ppb. The average TVOC concentrations during **the occupied time** was 345 ppb. On March 9 and March 10 outdoor spot measurements were taken and recorded as below the detection limit of the monitoring instrument for both dates. Based on US EPA research, office environments with TVOC concentrations up to about 400 ppb would be at little risk of IAQ complaint. Complaints might be expected if concentrations were significantly above 400 ppb.

The TVOC concentrations were non-detectable or just at the detection limit of the instrumentation within Room 351 for the duration of the 24-hour monitoring. Based on US EPA research, office environments with TVOC concentrations up to 400 ppb would be at little risk of IAQ concern. As this is a guideline, complaints might be expected if concentrations were significantly above 400 ppb.

Table IV – Summary of 24-Hour Data-logging IAQ based on Indoor Air Quality Measurement Criteria

Parameter	Measurement Average	Indoor Air Quality Measurement Criteria	Below Indoor Air Quality Measurement Criteria?
Carbon Dioxide	Room 125 472 ppm	Outdoor Air (ppm) + 700 ppm	Yes
	Room 351 697 ppm		
Carbon Monoxide	Room 125 0.04 ppm	5ppm	Yes
	Room 351 0 ppm		
Temperature (°C)	Room 125 22.8 °C	21 to 25 °C, winter clothing	Yes
	Room 351 23.5 °C		
Relative Humidity (%)	Room 125 8.1 %	25 to 65 %, for occupant comfort	No
	Room 351 11.6 %		

Table IV – Summary of 24-Hour Data-logging IAQ based on Indoor Air Quality Measurement Criteria

$PM_{2.5}$	Room 125 1 µg/m³	25 µg/m³	Yes
	Room 351 3.1 µg/m³		
TVOC	Room 125 235 ppb	400 ppb	Yes
	Room 351 **Below Detection Limit of Monitoring Instrument**		

4.0 DISCUSSION

The majority of the indoor air quality measurements collected were within recommended ranges and meet the criteria of the referenced guidelines. Carbon Dioxide concentrations suggested adequate ventilation. Carbon Monoxide concentrations did not suggest the presence of exhaust or combustion gases. Temperature measurements were within the recommended comfort ranges for office environments. Particulate Matter $PM_{2.5}$ concentrations were within typical ranges. The Pinchin inspector did not identify any deficiencies with regards to unusual odours during the investigation.

Relative Humidity measurements were below the recommended comfort range which may result in dry skin, eye and nose irritation. However, it should be noted that low relative humidity is a common wintertime condition in Canada.

5.0 RECOMMENDATIONS

Pinchin offers the following recommendations to improve air quality in this building.

1. Communicate the findings of this report to the staff, and health and safety representitive; and;
2. Review the humidification system in the building to ensure it is operational and functioning properly. Consider making adjustments as necessary.

6.0 TERMS AND LIMITATIONS

This work was performed subject to the Terms and Limitations presented or referenced in the proposal for this project.

Information provided by Pinchin is intended for Client use only. Pinchin will not provide results or information to any party unless disclosure by Pinchin is required by law. Any use by a third party of reports or documents authored by Pinchin or any reliance by a third party on or decisions made by a third party based on the findings described in said documents, is the sole responsibility of such third parties. Pinchin accepts no responsibility for damages suffered by any third party as a result of decisions made or actions conducted. No other warranties are implied or expressed.

\\pinchin.com\wpg\Job\306000s\0306866.000 UofM,89FREEDMAN,IAQ,ASSMNT\Deliverables\EITC 2\306866 Final IAQ Report for EITC 2 at 75 Chancellors U of M, Mar 31, 2022.docx

Template: Master Report Investigation of IAQ, IEQ, September 15, 2021

APPENDIX I

Drawings

N

LEGEND

DATA LOGGING LOCATION

BASE PLAN PROVIDED BY CLIENT.

PINCHIN

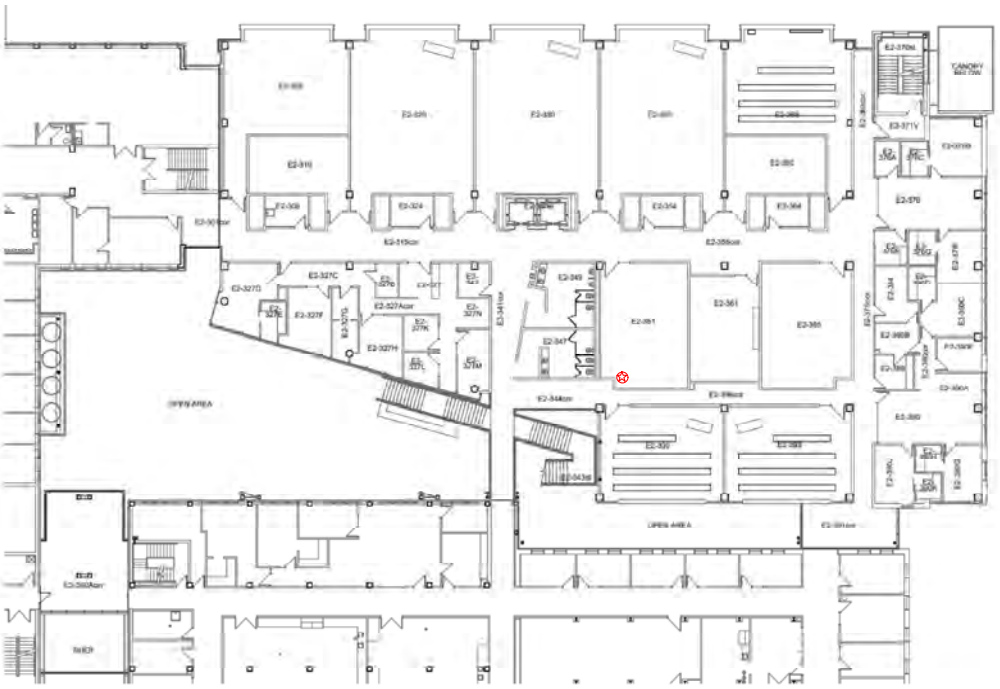
PROJECT NAME:
INDOOR AIR QUALITY ASSESSMENT

CLIENT NAME:
UNIVERSITY OF MANITOBA
EITC-2

PROJECT LOCATION:
75 CHANCELLORS CIRCLE
WINNIPEG, MANITOBA

FIGURE NAME:
LEVEL 100

PROJECT NUMBER:	SCALE:
306866	NOT TO SCALE
DRAWN BY:	REVIEWED BY:
CE	JB
DATE:	FIGURE NUMBER:
2022/03/17	1 OF 2



N

LEGEND

DATA LOGGING LOCATION

BASE PLAN PROVIDED BY CLIENT.

PINCHIN

PROJECT NAME:
INDOOR AIR QUALITY ASSESSMENT

CLIENT NAME:
UNIVERSITY OF MANITOBA
EITC-2

PROJECT LOCATION:
75 CHANCELLORS CIRCLE
WINNIPEG, MANITOBA

FIGURE NAME:
LEVEL 300

PROJECT NUMBER:	SCALE:
306866	NOT TO SCALE
DRAWN BY:	REVIEWED BY:
CE	JB
DATE:	FIGURE NUMBER:
2022/03/17	2 OF 2

APPENDIX II

Results of Data-Logging Indoor Air Quality Measurements

Session Report
75 Chancellors Circle
EITC 2- 125

3/8/2022

Datalog Period

Device Name	EML060008
Serial Number	EML060008
Run Time	23:44:34
Start Time	3/8/2022 7:16:02 AM
Stop Time	3/9/2022 7:00:36 AM

IAQ Data Summary

Description	Value	Description	Value
CO2Ave	472 PPM	CO2Max	921 PPM
CO2MaxTime	3/8/2022 11:46:56 AM	CO2Min	355 PPM
COAve	0 PPM	COMax	1 PPM
COMin	0 PPM	Dust Average	1.000 ug/m³
Dust Max	11.000 ug/m³	Dust Min	0.000 ug/m³
Humidity Avg	8.1 %	Humidity Max	17.6 %
Humidity Max Time	3/8/2022 10:28:55 AM	Humidity Min	3.5 %
Humidity Min Time	3/9/2022 6:55:28 AM	PIDAvePPB	235 ppb
PIDMaxPPB	4400 ppb	PIDMinPPB	Below Detection limit of Instrument
Temp Avg	22.8 °C	Temp Max Time	3/8/2022 4:01:04 PM
Temp Min Time	3/8/2022 7:16:02 AM	Temperature Max	23.4 °C
Temperature Min	20.8 °C		
Dust Impactor Setting	2.5 µm		

Session Report
75 Chancellors Circle
EITC 2- 351

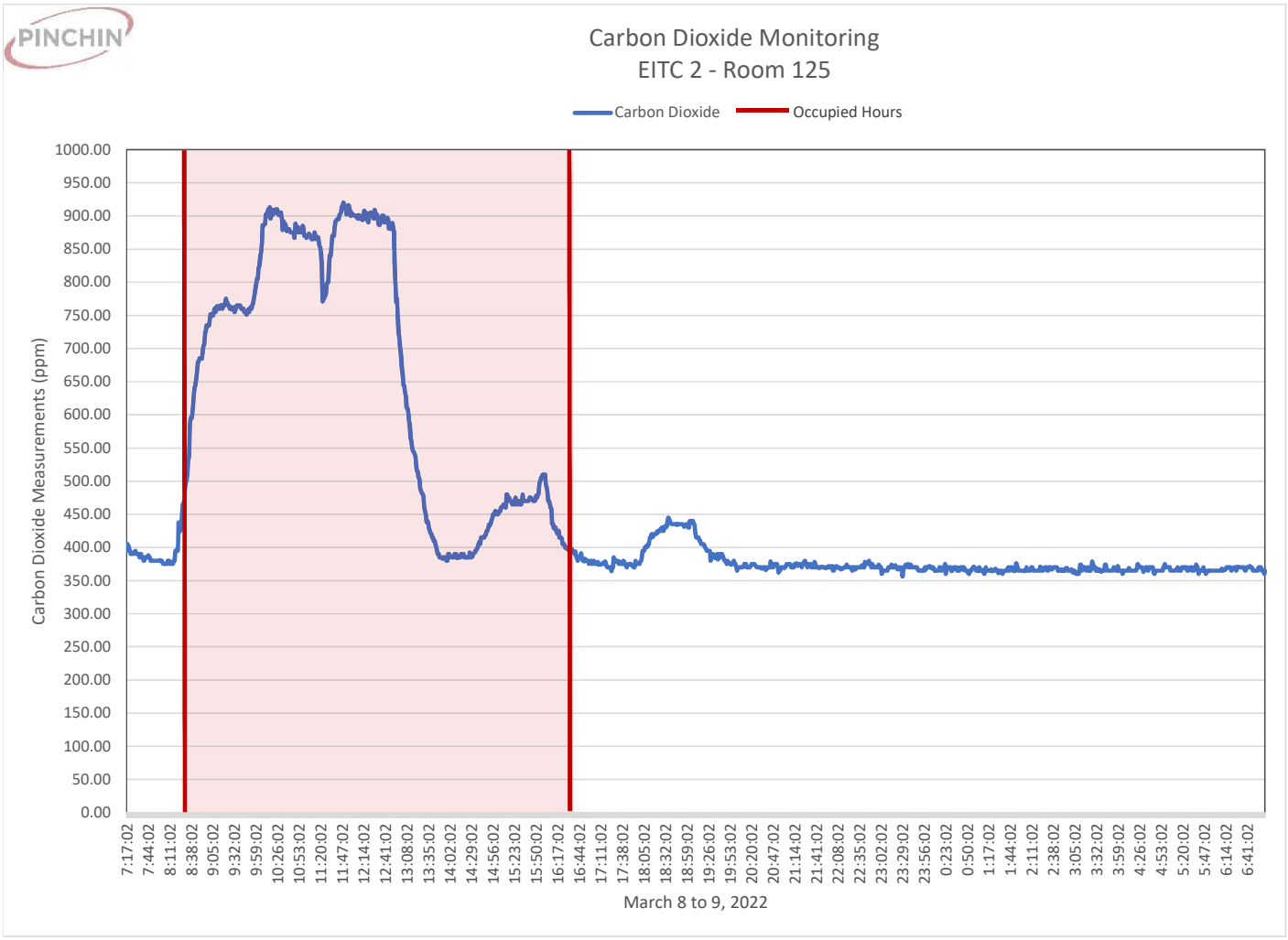
3/8/2022

Datalog Period

Device Name	EMI050016
Serial Number	EMI050016
Run Time	23:38:32
Start Time	3/8/2022 7:24:36 AM
Stop Time	3/9/2022 7:03:08 AM

IAQ Data Summary

Description	Value	Description	Value
CO2Ave	696 PPM	CO2Max	3,064 PPM
CO2MaxTime	3/8/2022 11:01:53 AM	CO2Min	418 PPM
COAve	0 PPM	COMax	0 PPM
COMin	0 PPM	Dust Average	3.000 ug/m³
Dust Max	35.000 ug/m³	Dust Min	0.000 ug/m³
Humidity Avg	11.6 %	Humidity Max	27.4 %
Humidity Max Time	3/8/2022 11:01:34 AM	Humidity Min	7.8 %
Humidity Min Time	3/9/2022 6:55:44 AM	PIDAvePPB	Below Detection Limit of Instrument
PIDMaxPPB	Below Detection Limit of Instrument	PIDMinPPB	Below Detection Limit of Instrument
Temp Avg	23.5 °C	Temp Max Time	3/8/2022 11:16:00 AM
Temp Min Time	3/8/2022 7:24:36 AM	Temperature Max	25.1 °C
Temperature Min	22.1 °C		
Dust Impactor Setting	2.5 µm		


PINCHIN
Carbon Dioxide Monitoring
EITC 2 - Room 125
Carbon Dioxide
Occupied Hours
Carbon Dioxide Measurements (ppm)
1000.00
950.00
900.00
850.00
800.00
750.00
700.00
650.00
600.00
550.00
500.00
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
7:17:02
7:44:02
8:11:02
8:38:02
9:05:02
9:32:02
9:59:02
10:26:02
10:53:02
11:20:02
11:47:02
12:14:02
12:41:02
13:08:02
13:35:02
14:02:02
14:29:02
14:56:02
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17:11:02
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19:53:02
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3:32:02
3:59:02
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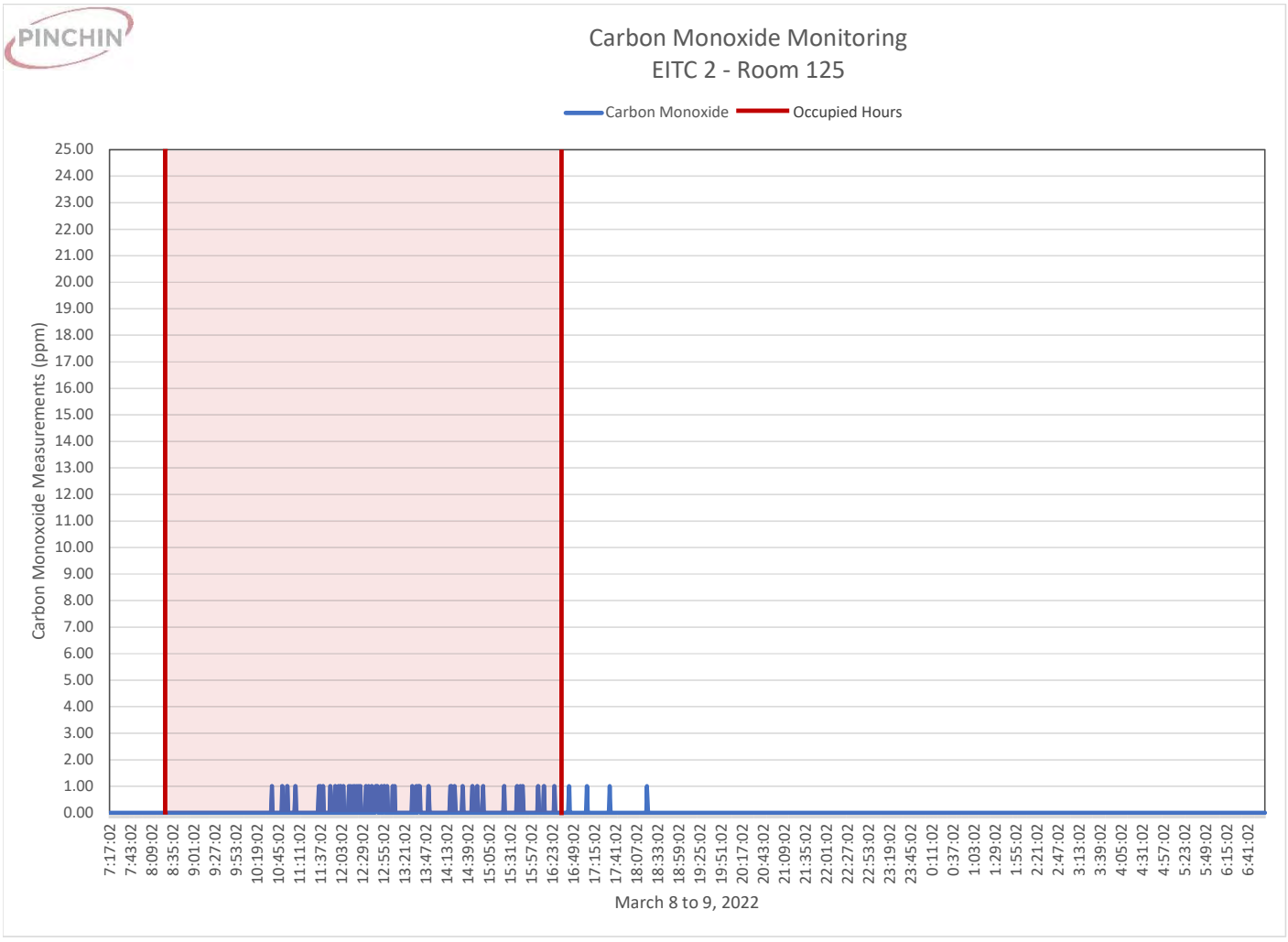
5:20:02
5:47:02
6:14:02
6:41:02
March 8 to 9, 2022


PINCHIN
Carbon Monoxide Monitoring
EITC 2 - Room 125
Carbon Monoxide
Occupied Hours
Carbon Monoxide Measurements (ppm)
25.00
24.00
23.00
22.00
21.00
20.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
7:17:02
7:43:02
8:09:02
8:35:02
9:01:02
9:27:02
9:53:02
10:19:02
10:45:02
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12:29:02
12:55:02
13:21:02
13:47:02
14:13:02
14:39:02
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3:39:02
4:05:02
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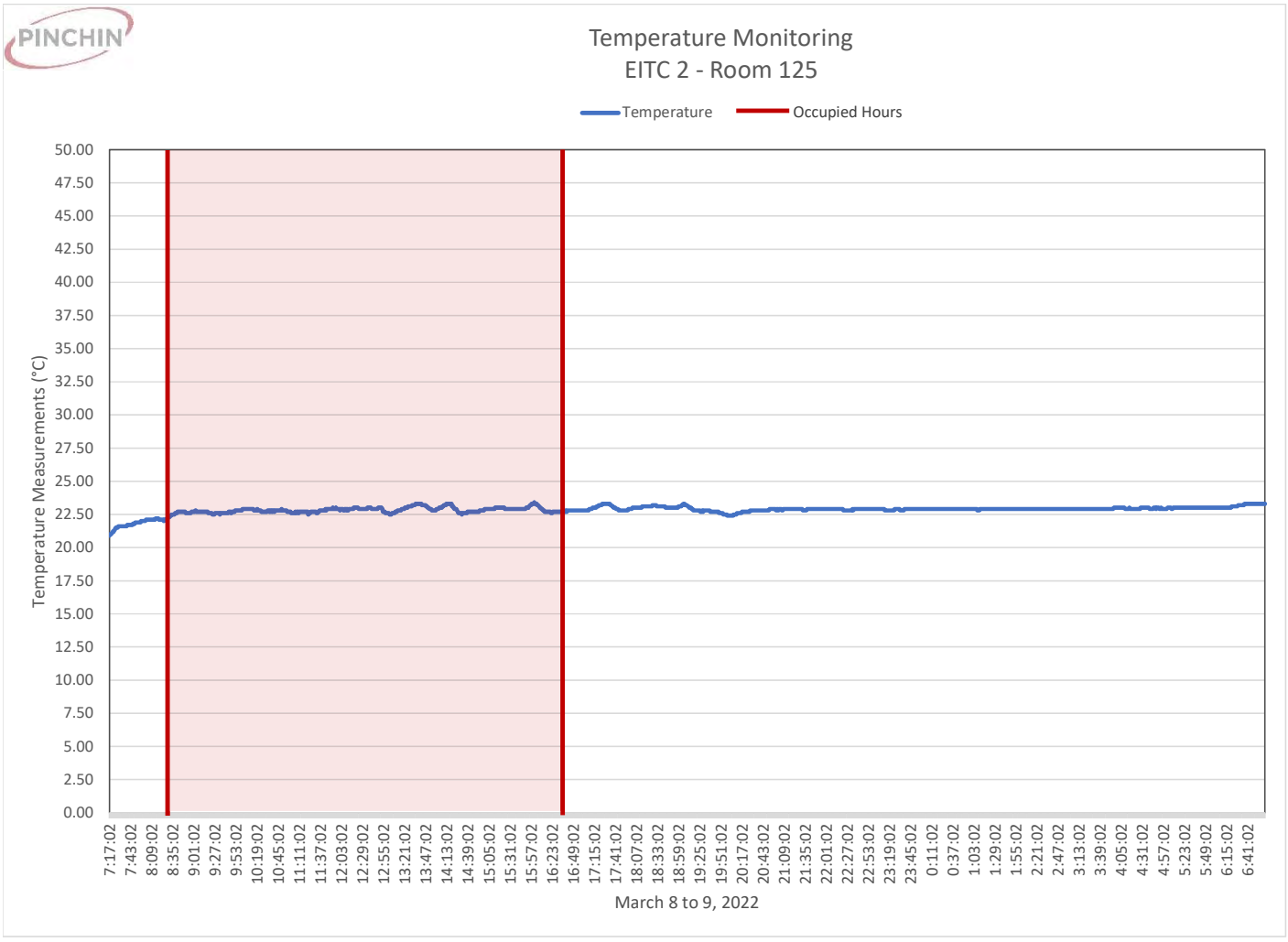
March 8 to 9, 2022


PINCHIN
Temperature Monitoring
EITC 2 - Room 125
Temperature
Occupied Hours
Temperature Measurements (°C)
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47.50
45.00
42.50
40.00
37.50
35.00
32.50
30.00
27.50
25.00
22.50
20.00
17.50
15.00
12.50
10.00
7.50
5.00
2.50
0.00
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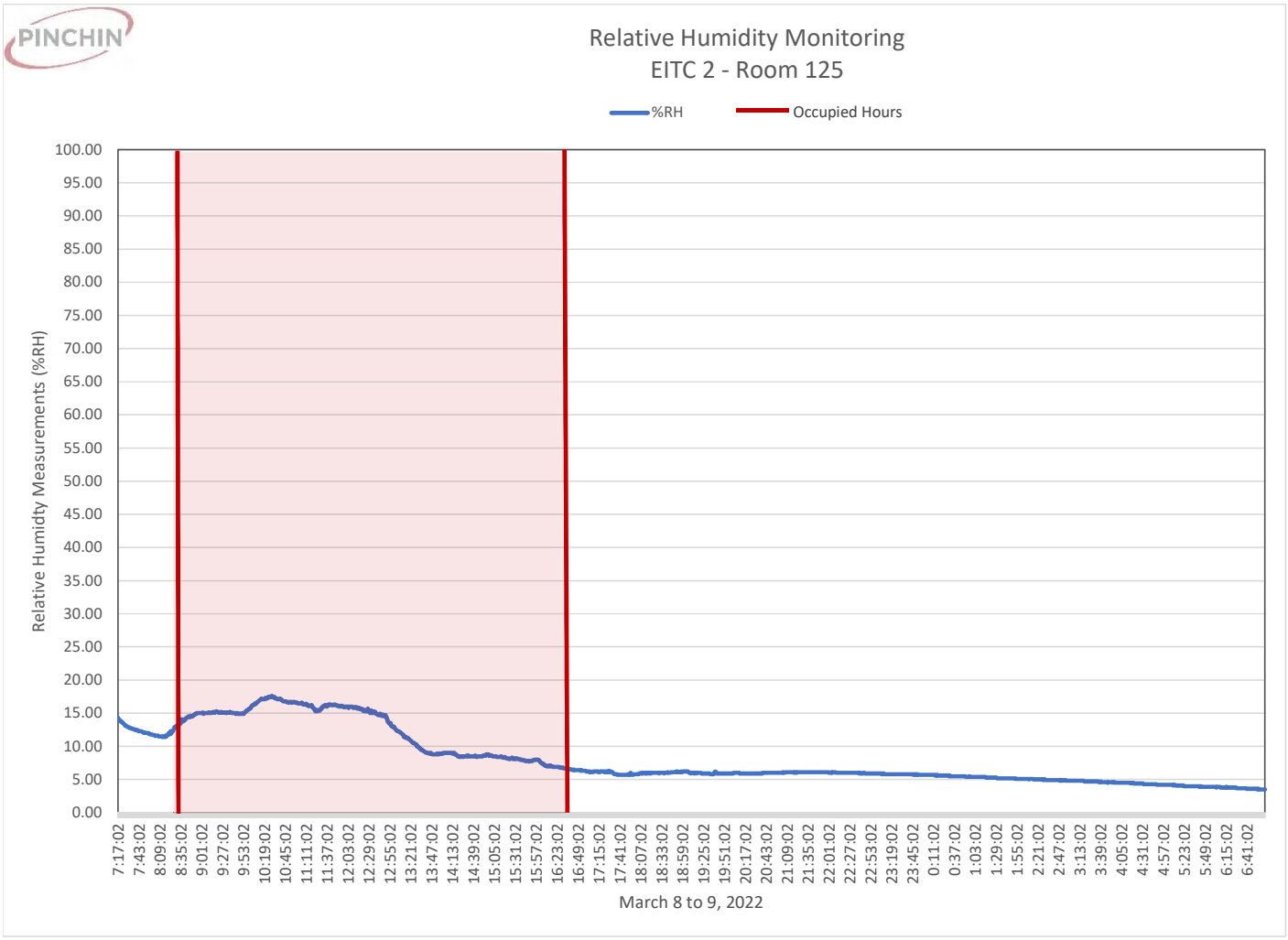
March 8 to 9, 2022


PINCHIN
Relative Humidity Monitoring
EITC 2 - Room 125
%RH
Occupied Hours
Relative Humidty Measurements (%RH)
100.00
95.00
90.00
85.00
80.00
75.00
70.00
65.00
60.00
55.00
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
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10:45:02
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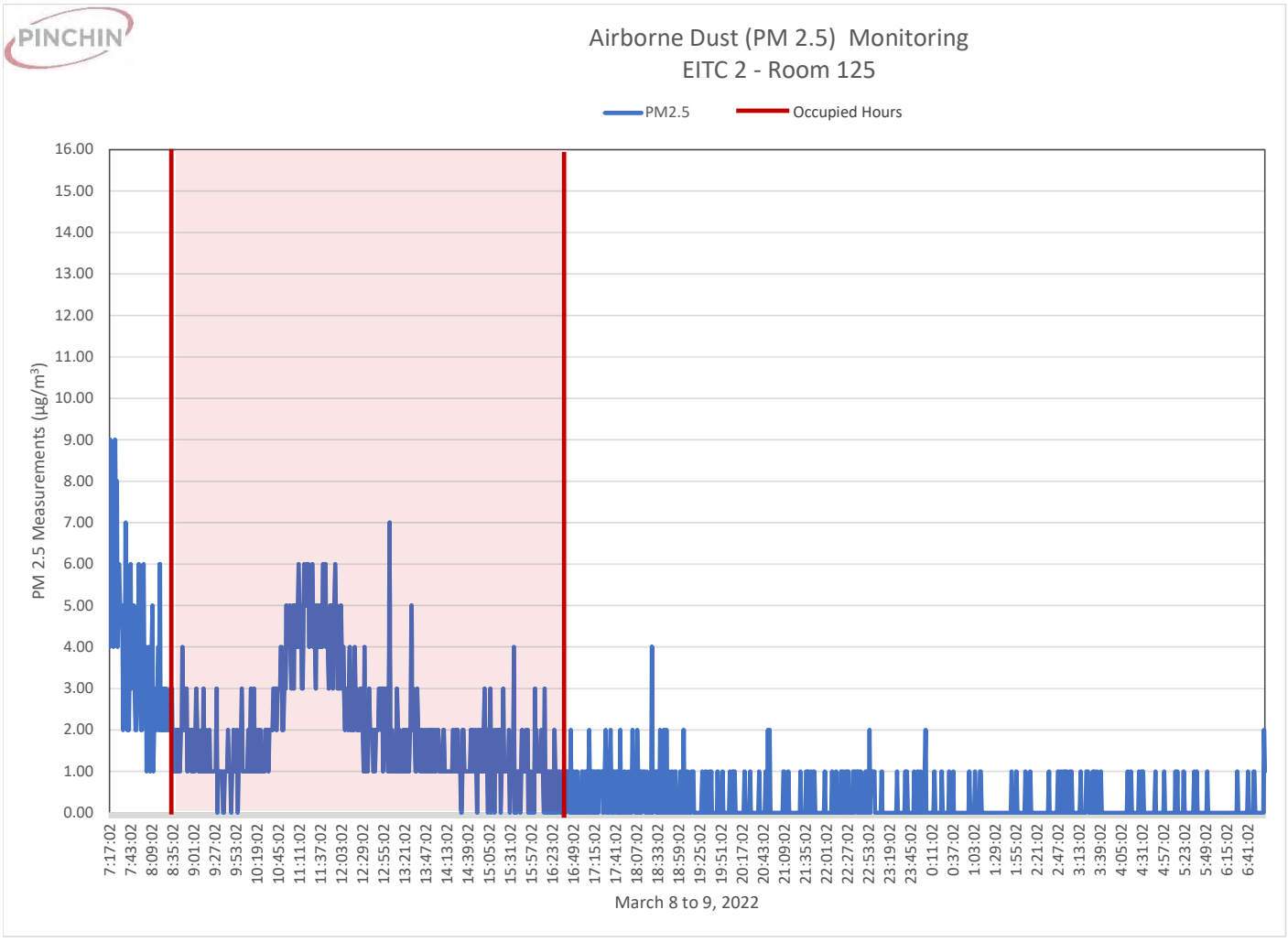
6:41:02
March 8 to 9, 2022


PINCHIN
Airborne Dust (PM 2.5) Monitoring
EITC 2 - Room 125
PM2.5
Occupied Hours
PM 2.5 Measurements (µg/m³)
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
7:17:02
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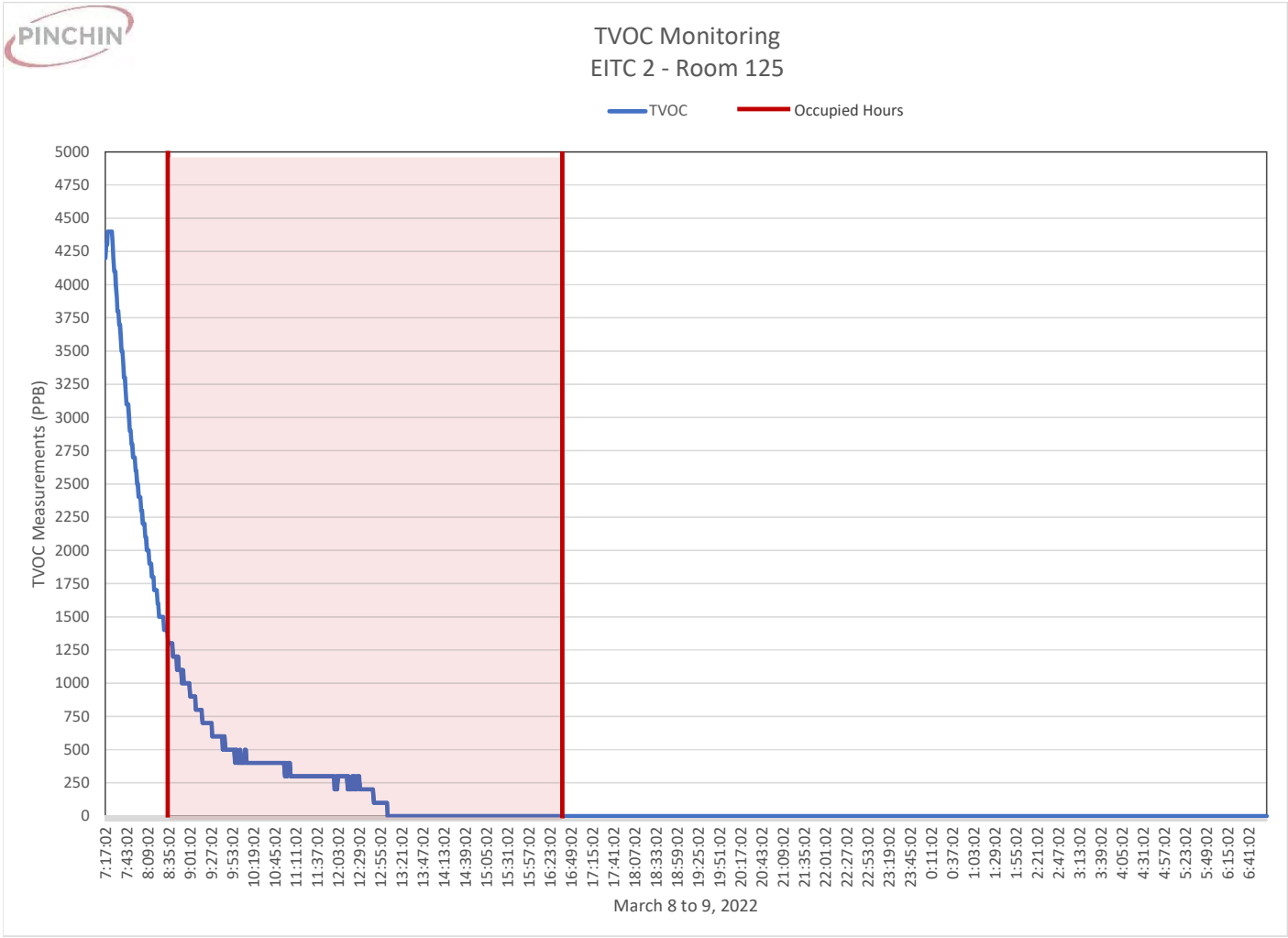
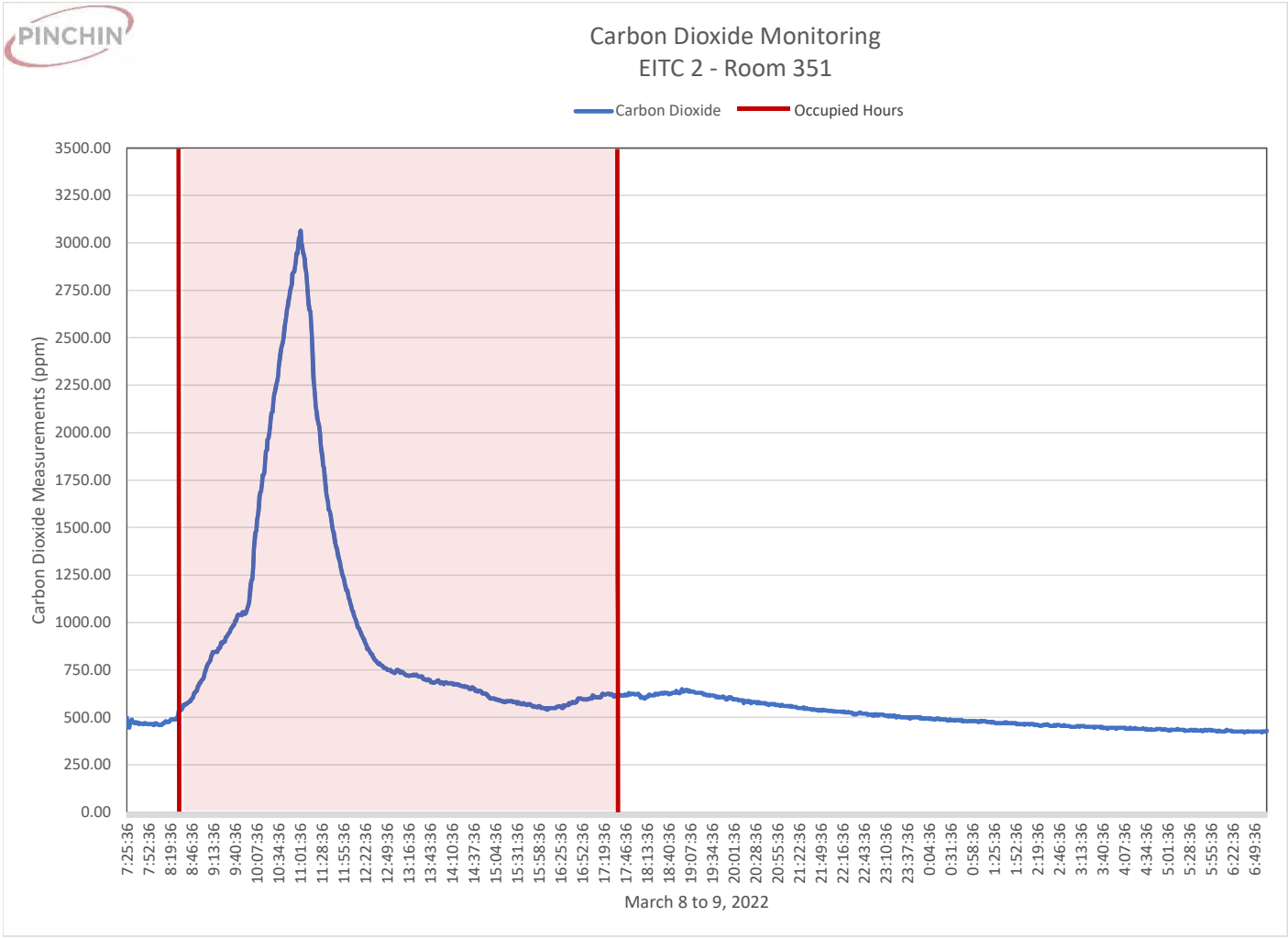
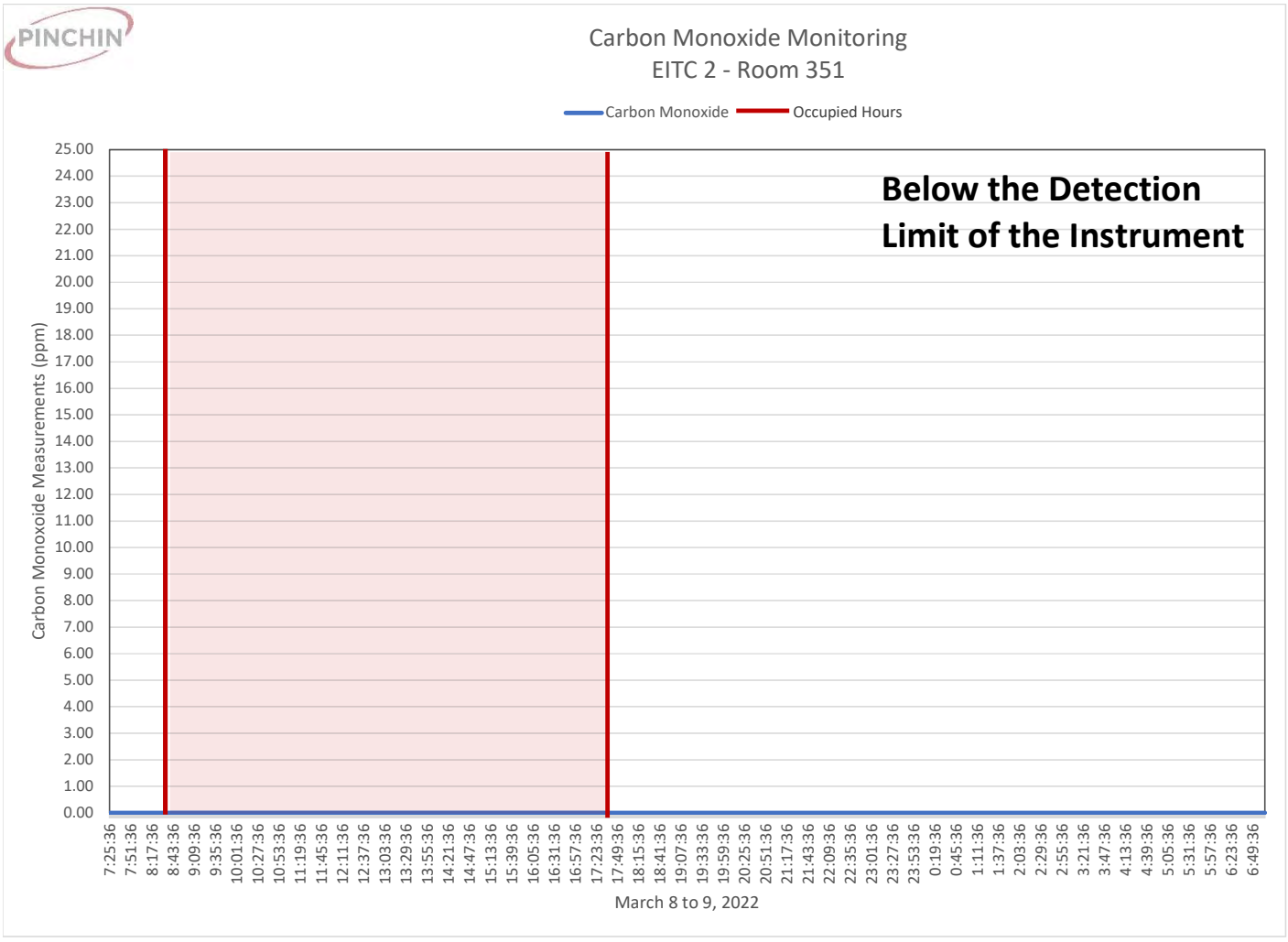
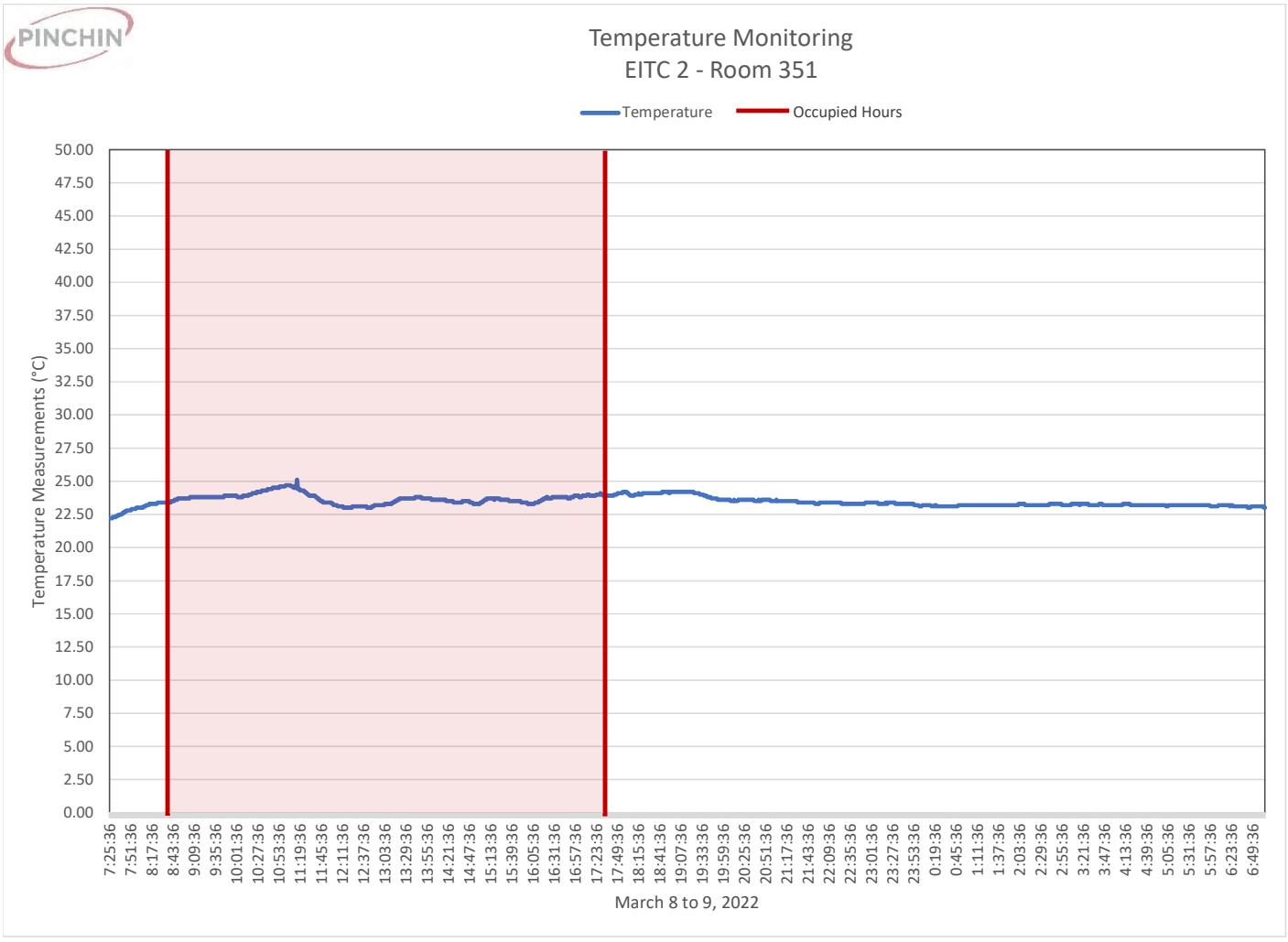
8:09:02
8:35:02
9:01:02
9:27:02
9:53:02
10:19:02
10:45:02
11:11:02
11:37:02
12:03:02
12:29:02
12:55:02
13:21:02
13:47:02
14:13:02
14:39:02
15:05:02
15:31:02
15:57:02
16:23:02
16:49:02
17:15:02
17:41:02
18:07:02
18:33:02
18:59:02
19:25:02
19:51:02
20:17:02
20:43:02
21:09:02
21:35:02
22:01:02
22:27:02
22:53:02
23:19:02
23:45:02
0:11:02
0:37:02
1:03:02
1:29:02
1:55:02
2:21:02
2:47:02
3:13:02
3:39:02
4:05:02
4:31:02
4:57:02
5:23:02
5:49:02
6:15:02
6:41:02
March 8 to 9, 2022


PINCHIN
TVOC Monitoring
EITC 2 - Room 125
TVOC
Occupied Hours
TVOC Measurements (PPB)
5000
4750
4500
4250
4000
3750
3500
3250
3000
2750
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
7:17:02
7:43:02
8:09:02
8:35:02
9:01:02
9:27:02
9:53:02
10:19:02
10:45:02
11:11:02
11:37:02
12:03:02
12:29:02
12:55:02
13:21:02
13:47:02
14:13:02
14:39:02
15:05:02
15:31:02
15:57:02
16:23:02
16:49:02
17:15:02
17:41:02
18:07:02
18:33:02
18:59:02
19:25:02
19:51:02
20:17:02
20:43:02
21:09:02
21:35:02
22:01:02
22:27:02
22:53:02
23:19:02
23:45:02
0:11:02
0:37:02
1:03:02
1:29:02
1:55:02
2:21:02
2:47:02
3:13:02
3:39:02
4:05:02
4:31:02
4:57:02
5:23:02
5:49:02
6:15:02
6:41:02
March 8 to 9, 2022


PINCHIN
Carbon Dioxide Monitoring
EITC 2 - Room 351
Carbon Dioxide
Occupied Hours
Carbon Dioxide Measurements (ppm)
3500.00
3250.00
3000.00
2750.00
2500.00
2250.00
2000.00
1750.00
1500.00
1250.00
1000.00
750.00
500.00
250.00
0.00
7:25:36
7:52:36
8:19:36
8:46:36
9:13:36
9:40:36
10:07:36
10:34:36
11:01:36
11:28:36
11:55:36
12:22:36
12:49:36
13:16:36
13:43:36
14:10:36
14:37:36
15:04:36
15:31:36
15:58:36
16:25:36
16:52:36
17:19:36
17:46:36
18:13:36
18:40:36
19:07:36
19:34:36
20:01:36
20:28:36
20:55:36
21:22:36
21:49:36
22:16:36
22:43:36
23:10:36
23:37:36
0:04:36
0:31:36
0:58:36
1:25:36
1:52:36
2:19:36
2:46:36
3:13:36
3:40:36
4:07:36
4:34:36
5:01:36
5:28:36
5:55:36
6:22:36
6:49:36
March 8 to 9, 2022


PINCHIN
Carbon Monoxide Monitoring
EITC 2 - Room 351
Carbon Monoxide
Occupied Hours
Below the Detection Limit of the Instrument
Carbon Monoxide Measurements (ppm)
25.00
24.00
23.00
22.00
21.00
20.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
7:25:36
7:51:36
8:17:36
8:43:36
9:09:36
9:35:36
10:01:36
10:27:36
10:53:36
11:19:36
11:45:36
12:11:36
12:37:36
13:03:36
13:29:36
13:55:36
14:21:36
14:47:36
15:13:36
15:39:36
16:05:36
16:31:36
16:57:36
17:23:36
17:49:36
18:15:36
18:41:36
19:07:36
19:33:36
19:59:36
20:25:36
20:51:36
21:17:36
21:43:36
22:09:36
22:35:36
23:01:36
23:27:36
23:53:36
0:19:36
0:45:36
1:11:36
1:37:36
2:03:36
2:29:36
2:55:36
3:21:36
3:47:36
4:13:36
4:39:36
5:05:36
5:31:36
5:57:36
6:23:36
6:49:36
March 8 to 9, 2022


PINCHIN
Temperature Monitoring
EITC 2 - Room 351
Temperature
Occupied Hours
Temperature Measurements (°C)
50.00
47.50
45.00
42.50
40.00
37.50
35.00
32.50
30.00
27.50
25.00
22.50
20.00
17.50
15.00
12.50
10.00
7.50
5.00
2.50
0.00
7:25:36
7:51:36
8:17:36
8:43:36
9:09:36
9:35:36
10:01:36
10:27:36
10:53:36
11:19:36
11:45:36
12:11:36
12:37:36
13:03:36
13:29:36
13:55:36
14:21:36
14:47:36
15:13:36
15:39:36
16:05:36
16:31:36
16:57:36
17:23:36
17:49:36
18:15:36
18:41:36
19:07:36
19:33:36
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20:51:36
21:17:36
21:43:36
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23:01:36
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1:37:36
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2:29:36
2:55:36
3:21:36
3:47:36
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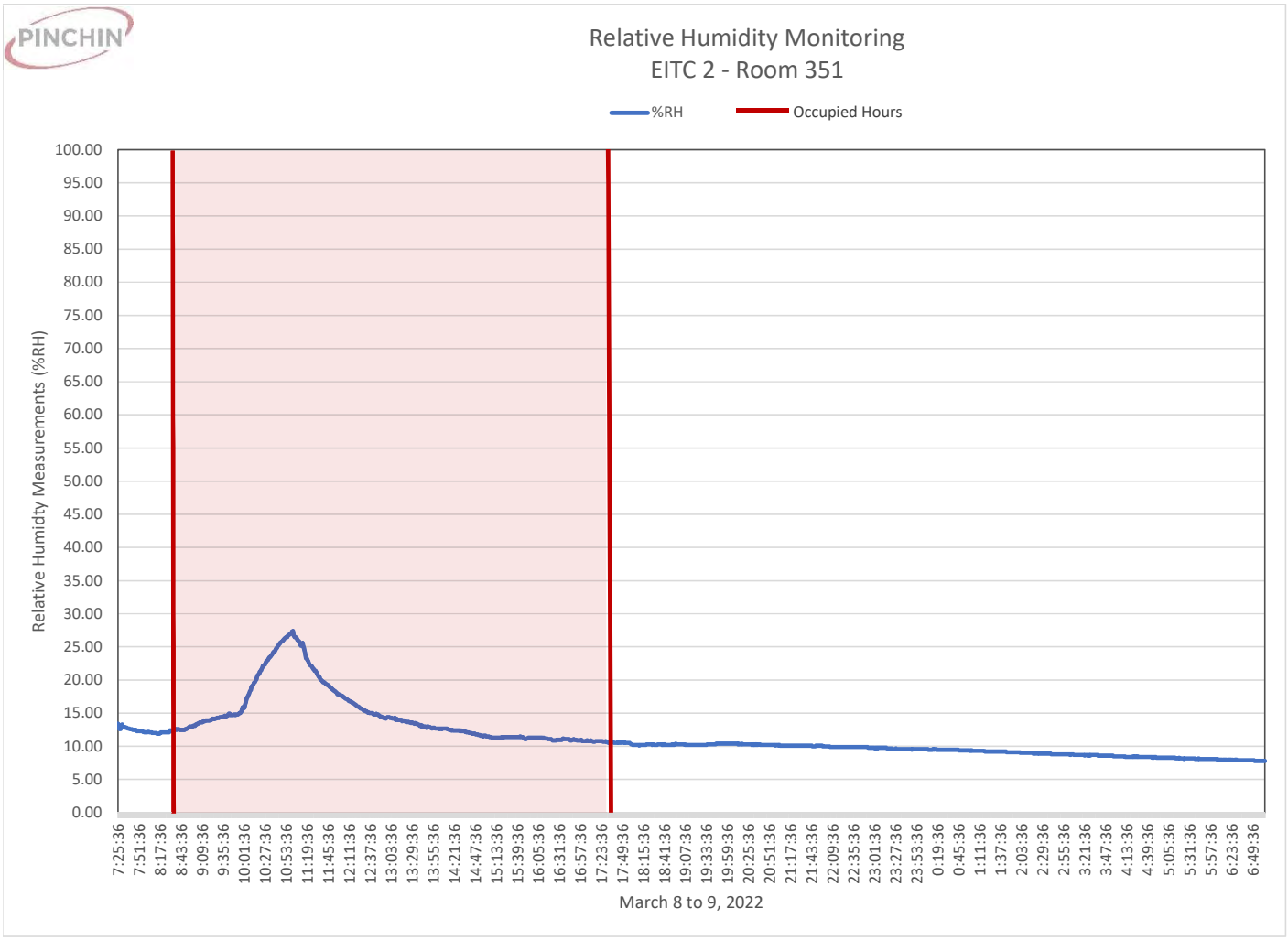
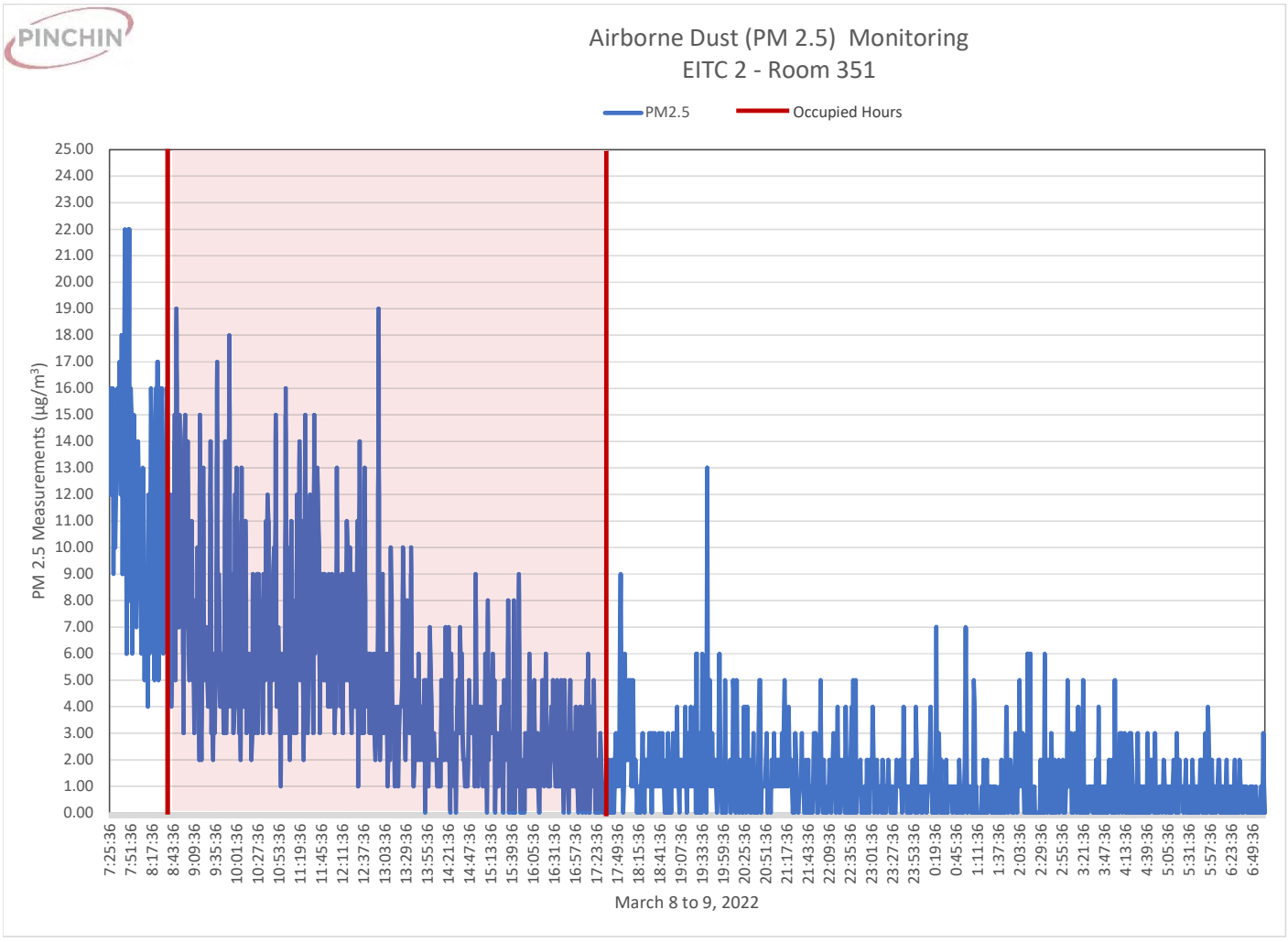
6:23:36
6:49:36
March 8 to 9, 2022


PINCHIN
Relative Humidity Monitoring
EITC 2 - Room 351
%RH
Occupied Hours
Relative Humidty Measurements (%RH)
100.00
95.00
90.00
85.00
80.00
75.00
70.00
65.00
60.00
55.00
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
7:25:36
7:51:36
8:17:36
8:43:36
9:09:36
9:35:36
10:01:36
10:27:36
10:53:36
11:19:36
11:45:36
12:11:36
12:37:36
13:03:36
13:29:36
13:55:36
14:21:36
14:47:36
15:13:36
15:39:36
16:05:36
16:31:36
16:57:36
17:23:36
17:49:36
18:15:36
18:41:36
19:07:36
19:33:36
19:59:36
20:25:36
20:51:36
21:17:36
21:43:36
22:09:36
22:35:36
23:01:36
23:27:36
23:53:36
0:19:36
0:45:36
1:11:36
1:37:36
2:03:36
2:29:36
2:55:36
3:21:36
3:47:36
4:13:36
4:39:36
5:05:36
5:31:36
5:57:36
6:23:36
6:49:36
March 8 to 9, 2022


PINCHIN
Airborne Dust (PM 2.5) Monitoring
EITC 2 - Room 351
PM2.5
Occupied Hours
PM 2.5 Measurements (µg/m³)
25.00
24.00
23.00
22.00
21.00
20.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
7:25:36
7:51:36
8:17:36
8:43:36
9:09:36
9:35:36
10:01:36
10:27:36
10:53:36
11:19:36
11:45:36
12:11:36
12:37:36
13:03:36
13:29:36
13:55:36
14:21:36
14:47:36
15:13:36
15:39:36
16:05:36
16:31:36
16:57:36
17:23:36
17:49:36
18:15:36
18:41:36
19:07:36
19:33:36
19:59:36
20:25:36
20:51:36
21:17:36
21:43:36
22:09:36
22:35:36
23:01:36
23:27:36
23:53:36
0:19:36
0:45:36
1:11:36
1:37:36
2:03:36
2:29:36
2:55:36
3:21:36
3:47:36
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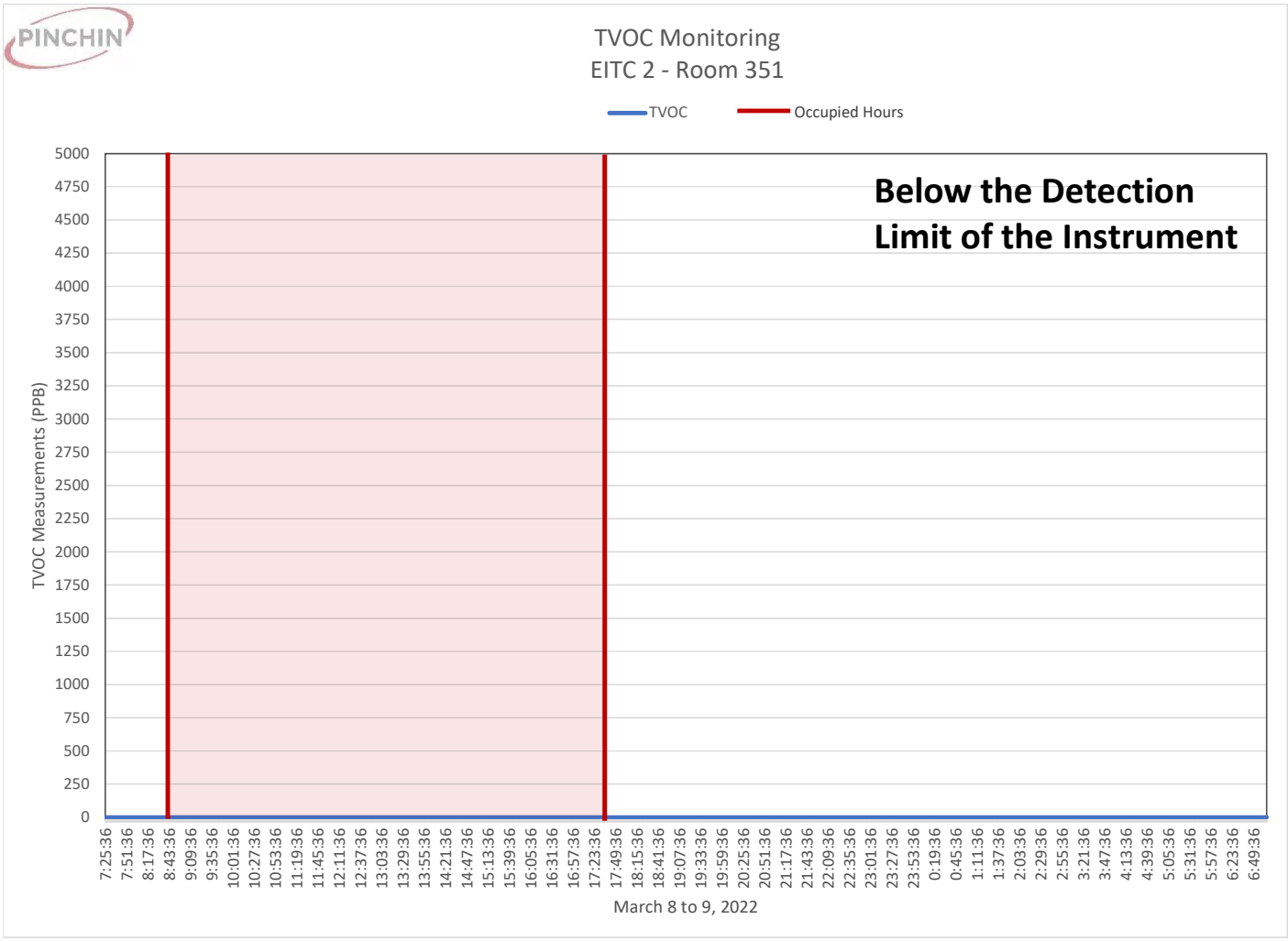
4:39:36
5:05:36
5:31:36
5:57:36
6:23:36
6:49:36
March 8 to 9, 2022


PINCHIN
TVOC Monitoring
EITC 2 - Room 351
TVOC
Occupied Hours
Below the Detection Limit of the Instrument
TVOC Measurements (PPB)
5000
4750
4500
4250
4000
3750
3500
3250
3000
2750
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
7:25:36
7:51:36
8:17:36
8:43:36
9:09:36
9:35:36
10:01:36
10:27:36
10:53:36
11:19:36
11:45:36
12:11:36
12:37:36
13:03:36
13:29:36
13:55:36
14:21:36
14:47:36
15:13:36
15:39:36
16:05:36
16:31:36
16:57:36
17:23:36
17:49:36
18:15:36
18:41:36
19:07:36
19:33:36
19:59:36
20:25:36
20:51:36
21:17:36
21:43:36
22:09:36
22:35:36
23:01:36
23:27:36
23:53:36
0:19:36
0:45:36
1:11:36
1:37:36
2:03:36
2:29:36
2:55:36
3:21:36
3:47:36
4:13:36
4:39:36
5:05:36
5:31:36
5:57:36
6:23:36
6:49:36
March 8 to 9, 2022

FINAL

Investigation of Indoor Air Quality

EITC-3

75B Chancellors Circle, Winnipeg, Manitoba

Prepared for:

University of Manitoba
120 Physical Plant,
89 Freedman Crescent
Winnipeg, Manitoba, R3T 2N2

March 31, 2022

Pinchin File: 306866

Issued to: **University of Manitoba**
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Pinchin File: **306866**
Issuing Office: **Winnipeg, MB**

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EXECUTIVE SUMMARY

Pinchin Ltd. (Pinchin) was retained by University of Manitoba (the Client) to conduct an investigation of indoor air quality (IAQ) that included 24-hour monitoring. The work was conducted at 75B Chancellors Circle, Winnipeg, Manitoba. Room 516 of the EITC-3 building was the data logging location chosen by the client as it was fully occupied by staff and students during the hours of 14:30-17:15. Room 516 is located on the 5th floor of the EITC-3 building at the Fort Garry campus. The client also requested that in this location, observations be made specifically to the cleanliness of supply air diffusers and return air grilles. As this is a follow up to the October 5, 2021 assessment, a re-inspection of the Heating Ventilation Air Conditioning (HVAC) system was not performed.

The majority of the indoor air quality measurements collected were within recommended ranges and meet the criteria of the referenced guidelines. Carbon Dioxide concentrations suggested adequate ventilation. Carbon Monoxide concentrations did not suggest the presence of exhaust or combustion gases. Temperature measurements were within the recommended comfort ranges for office environments. Particulate Matter ($PM_{2.5}$) concentrations were within typical ranges. Total Volatile Organic Compound concentrations (TVOCs) were within the recommended range. The Pinchin inspector did not identify any deficiencies with regards to unusual odours, during the investigation.

Relative Humidity measurements were below the recommended comfort range which may result in dry skin, eye and nose irritation. However, it should be noted that low relative humidity is a common wintertime condition in Canada.

The following recommendations are offered to improve air quality in this building:

1. Communicate the findings of this report to the staff, health and safety representative; and
2. Review the humidification system in the building to ensure it is operational and functioning properly. Consider making adjustments as necessary.

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1.0 INTRODUCTION AND SCOPE

1.1 Statement of Understanding

Pinchin Ltd. (Pinchin) was retained by University of Manitoba (the Client) to conduct an investigation of indoor air quality (IAQ) that included 24-hour monitoring. The work was conducted at 75B Chancellors Circle, Winnipeg, Manitoba. Room 516 of the EITC-3 building was the data logging location chosen by the client as it was fully occupied by staff and students throughout the daytime hours. Room 516 is located on the 5th floor of the EITC-3 Building at the Fort Garry campus. The client also requested that in this location, observations be made specifically to the cleanliness of supply air diffusers and return air grilles. As this is a follow up to the October 5, 2021 assessment, a re-inspection of the Heating Ventilation Air Conditioning (HVAC) system was not performed.

1.2 Scope of Work

Pinchin performed the investigation on March 8 to March 9, 2022. The scope of this investigation was limited to Room 516.

The investigation involved the following activities:

- Walkthrough site reviews for factors that could degrade air quality; and
- 24 Hour Data-logging of Carbon Dioxide (CO_2), Carbon Monoxide (CO), Temperature (Temp), Relative Humidity (RH), Total Volatile Organic Compounds (TVOCs) and Particulate Matter smaller than 2.5 micrometres ($PM_{2.5}$) within Room 516.

2.0 METHODOLOGY

2.1 Interviews and Site Reviews

Pinchin interviewed the University of Manitoba Physical Plant, Project and Building Managers to discuss the history of the building, maintenance practices and any indoor air quality concerns.

The investigator did not perform any destructive work to inspect concealed conditions inside wall and/or ceiling cavities.

2.2 Test Methods and Criteria

The following table presents the parameters measured in this investigation, the instruments and sampling/analytical methods used, the applicable units of measurement, and the Indoor Air Quality criteria used for the evaluation of the results.

Table I – IAQ Parameters Tested, Measurement Criteria and Instruments

Parameter	Unit of Measurement	Recommended Limit	Instrumentation
Carbon dioxide, CO_2	Parts per million in air (ppm)	Outdoor Air (ppm) + 700 ppm [1]	24 hour Data-log Monitoring using a 3M® EVM-7 Air Quality Monitor
Carbon monoxide, CO	ppm	5 ppm [2]	
Temperature, T	°C	21 to 25 °C, winter clothing [3]	
Relative Humidity, RH	%RH	25[4] to 65[5] %, for occupant comfort	
Total Volatile Organic Compounds, (TVOC)	Parts per billion (ppb)	400 ppb[6]	
Particulate Matter smaller than 2.5 micrometres, $PM_{2.5}$	µg/m³	25 µg/m³ [7]24-hour mean;	24 hour Data-log Monitoring using an EVM-7 Air Quality Monitor

All data-logging direct-reading instruments were calibrated before use.

1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Ventilation for Acceptable Indoor Air Quality* [ANSI/ASHRAE Standard 62.1-2019]. Atlanta, GA: ASHRAE, 2019.
2 Health Canada: *Indoor Air Quality in Office Buildings: A Technical Guide*. Ottawa, ON: Health Canada, 1995.
3 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Thermal Environmental Conditions for Human Occupancy* [ANSI/ASHRAE Standard 55-2020]. Atlanta, GA: ASHRAE, 2020.
4 L.E. Burton, J.G. Girman, S.E. Womble: Airborne particulate matter within 100 randomly selected office buildings in the United States (BASE). Proceedings of Healthy Buildings 2000, Vol. 1 (2001).
5 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Thermal Environmental Conditions for Human Occupancy* [ANSI/ASHRAE Standard 55-2020]. Atlanta, GA:ASHRAE, 2020.
6 Value calculated from: US Environmental Protection Agency (EPA) "Building Assessment Survey and Evaluation (BASE) Study [Online] Available at http://www.epa.gov/iaq/base/summarized_data.html#Volatile_Organic_Compounds (Accessed August 25, 2014).
7 W. Team, "WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide : global update 2005 : summary of risk assessment", Apps.who.int, 2021. [Online]. Available: http://apps.who.int/iris/handle/10665/69477. [Accessed: 15-Sep- 2021].

3.0 FINDINGS

3.1 Results of Interviews

Project or Building Manager reported the following:

- Air Handling Units (AHU) filters are changed every three months or as needed;
- The occupant capacity within Room 516 is 32 people; and
- The enrollment/class ranges from 12 to 25 people.

3.2 Facility Description

Table II – Facility Description

Item	Details
Construction Date	1913
Number of Floors	Five floors above grade, one floor below grade
Structural Type	Steel
Foundation Type	Concrete
Exterior Cladding	Brick
HVAC	Forced air
Roof	Built up
Flooring	Ceramic tile
Interior Walls	Drywall
Ceilings	Acoustic ceiling tile

3.3 Results of Site Reviews

Appendix I presents the drawing.

During the investigation Pinchin noted the supply diffusers were clear from any obstructions, and were observed clean (Photo #1)

Refer to Table III for photographs from the investigation.

Table III – Photographs from Investigation

Photo 1 - Room 516 supply diffusers

3.4 Results of Indoor Air Quality Tests

Appendix II presents the results of data-logging for IAQ parameters.

The EVM 7 air monitor was used for 24-hour data logging within Room 516, of $PM_{2.5}$, CO_2, CO, TVOC, Temperature, and Relative Humidity. The EVM-7 is a direct-reading and datalogging instrument and was calibrated before use.

3.4.1 Carbon Dioxide (CO_2)

The 24-hour minimum CO_2 concentration recorded within the building was 351 ppm, the maximum CO_2 concentration was 675 ppm. The 24-hour average for CO_2 was 424.87. The average CO_2 concentration during **the occupied time** was 589 ppm. On March 8 and March 9 outdoor spot measurements were recorded. The average outdoor CO2 spot measurement for the two days was 445 ppm.. The indoor Carbon Dioxide concentrations were below the limit of 1,145 ppm (445 ppm outdoors plus 700 ppm) recommended by American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) to provide indoor air quality acceptable to the majority of occupants. This indicates that the supply of outdoor air was adequate for the occupancy loading at the time of the investigation.

3.4.2 Carbon Monoxide (CO)

The 24-hour minimum CO concentration recorded within the building was below the detection limit of the instrumentation, the maximum CO concentration was 1 ppm. The 24-hour average for CO was 0.15 ppm. The average CO concentration during **the occupied time** was 0.01 ppm. On March 8 and March 9 outdoor spot measurements were recorded. The average outdoor CO spot measurements for the two days was below the detection limit of the instrumentation. Health Canada advises that the detection of carbon monoxide above 5 ppm indicates a concern requiring further investigation.

3.4.3 Temperature (Temp)

The 24-hour minimum temperature measurement was 22.0 °C, the maximum temperature measurement was 25.2 °C. The 24-hour average temperature measurement was 24.11 °C. The average temperature measurement during **the occupied time** was 23.0 °C. On March 8 and March 9 outdoor spot measurements were taken each day. The average outdoor spot measurements for Temperature was -13.5 °C for the two days. The Temperatures were within the recommended comfort ranges for office environments for typical dress during winter conditions, of 21 to 25 °C

3.4.4 Relative Humidity (RH)

The 24-hour minimum Relative Humidity measurement was 8.5 %RH, the maximum measurement was 19.4 %RH. The 24-hour average measurement for relative humidity averaged 4.9 %RH. The average relative humidity measurement during **the occupied time** was 16.1 %RH. On March 8 and March 9 outdoor spot measurements were taken each day. The average outdoor spot measurements for Relative Humidity was 75.5 %RH for the two days. Relative humidity below 25 %RH may result in complaints of dry skin and eye and nose irritation. Low relative humidity is a common winter time condition in Canada due to difficulties with humidification.

3.4.5 Particulate Matter ($PM_{2.5}$)

The 24-hour minimum concentration for $PM_{2.5}$ was below the detection limit of the monitoring instrument. The maximum concentration for $PM_{2.5}$ was 10 µg/m³. The 24-hour average concentration for $PM_{2.5}$ was 0.21 µg/m³ , The average $PM_{2.5}$ concentration during **the occupied time** was 0.08 µg/m³. On March 8 and March 9 outdoor spot measurements were taken each day. The average outdoor $PM_{2.5}$ spot measurements for the two days was 5 µg/m³ . For reference, World Health Organization (WHO) provides a guideline of 25 µg/m³ over a 24-hour period. The $PM_{2.5}$ concentrations in this building fell within the range typically measured in commercial buildings.

3.4.6 Total Volatile Organic Compounds (TVOC)

The TVOC concentrations were non-detectable or just at the detection limit of the instrumentation. Based on US EPA research, office environments with TVOC concentrations up to about 400 ppb would be at little risk of IAQ complaint. Complaints might be expected if concentrations were significantly above 400 ppb.

Table IV – Summary of 24-Hour Data-logging IAQ based on Indoor Air Quality Measurement Criteria

Parameter	**Measurement Average**	**Indoor Air Quality Measurement Criteria**	**Below Indoor Air Quality Measurement Criteria?**
Carbon Dioxide	424.87 ppm	Outdoor Air (ppm) + 700 ppm	Yes
Carbon Monoxide	0.15 ppm	5ppm	Yes
Temperature (°C)	24.11 °C	21 to 25 °C, winter clothing	Yes
Relative Humidity (%)	13.0 %	25 to 65 %, for occupant comfort	No
$PM_{2.5}$	0.21 µg/m³	25 µg/m³	Yes
TVOC	**Below Detection Limit of Instrument**	400 ppb	Yes

4.0 DISCUSSION

The majority of the indoor air quality measurements collected were within recommended ranges and meet the criteria of the referenced guidelines. Carbon Dioxide concentrations suggested adequate ventilation. Carbon Monoxide concentrations did not suggest the presence of exhaust or combustion gases. Temperature measurements were within the recommended comfort ranges for office environments. $PM_{2.5}$ concentrations were within typical ranges. Total Volatile Organic Compound (TVOC) concentrations were within the recommended range. The Pinchin inspector did not identify any deficiencies with regards to unusual odours, during the investigation.

Relative Humidity measurements were below the recommended comfort range which may result in dry skin, eye and nose irritation. However, it should be noted that low relative humidity is a common wintertime condition in Canada.

Air Handling Units within the building were not inspected as they were done during the last survey.

5.0 RECOMMENDATIONS

Pinchin offers the following recommendations to improve air quality in this building.

1. Communicate the findings of this report to the staff, and health and safety representitive; and
2. Review the humidification system in the building to ensure it is operational and functioning properly. Consider making adjustments as necessary.

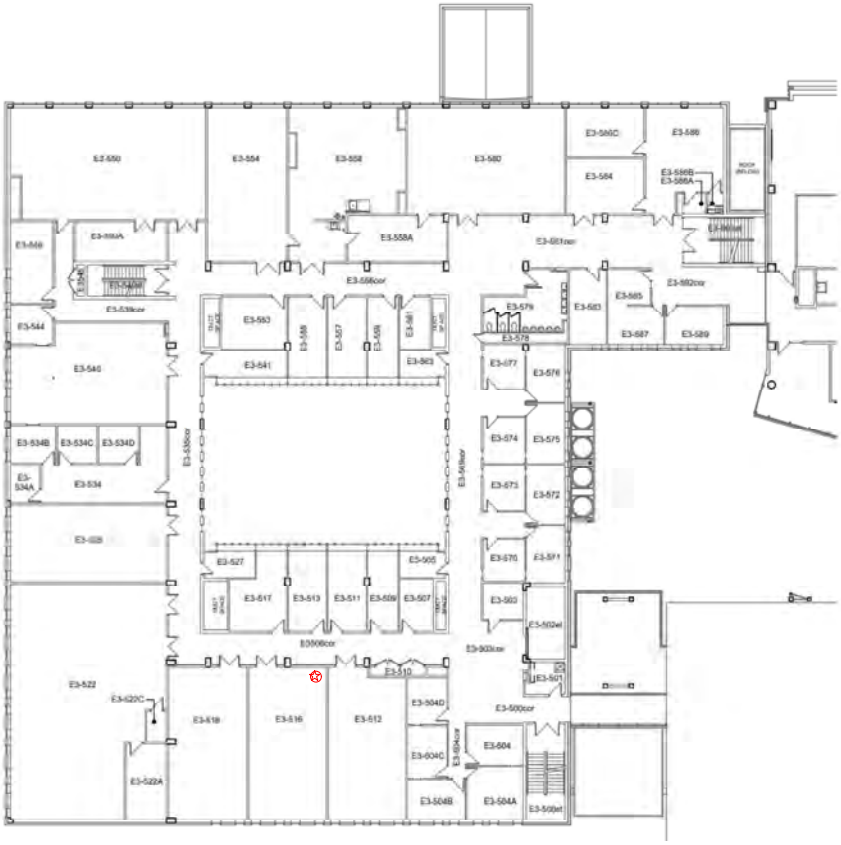
6.0 TERMS AND LIMITATIONS

This work was performed subject to the Terms and Limitations presented or referenced in the proposal for this project.

Information provided by Pinchin is intended for Client use only. Pinchin will not provide results or information to any party unless disclosure by Pinchin is required by law. Any use by a third party of reports or documents authored by Pinchin or any reliance by a third party on or decisions made by a third party based on the findings described in said documents, is the sole responsibility of such third parties. Pinchin accepts no responsibility for damages suffered by any third party as a result of decisions made or actions conducted. No other warranties are implied or expressed.

APPENDIX I

Drawing



N

LEGEND

DATA LOGGING LOCATION

BASE PLAN PROVIDED BY CLIENT.

PINCHIN

PROJECT NAME:
INDOOR AIR QUALITY ASSESSMENT

CLIENT NAME:
UNIVERSITY OF MANITOBA EITC-3

PROJECT LOCATION:
75B CHANCELLORS CIRCLE WINNIPEG, MANITOBA

FIGURE NAME:
LEVEL 500

PROJECT NUMBER:	SCALE:
306866	NOT TO SCALE
DRAWN BY:	REVIEWED BY:
CE	JB
DATE:	FIGURE NUMBER:
2022/03/17	1 OF 1

APPENDIX II

Results of Data-Logging Indoor Air Quality Measurements

Session Report
75B Chancellors Circle
EITC- 3 Room 516

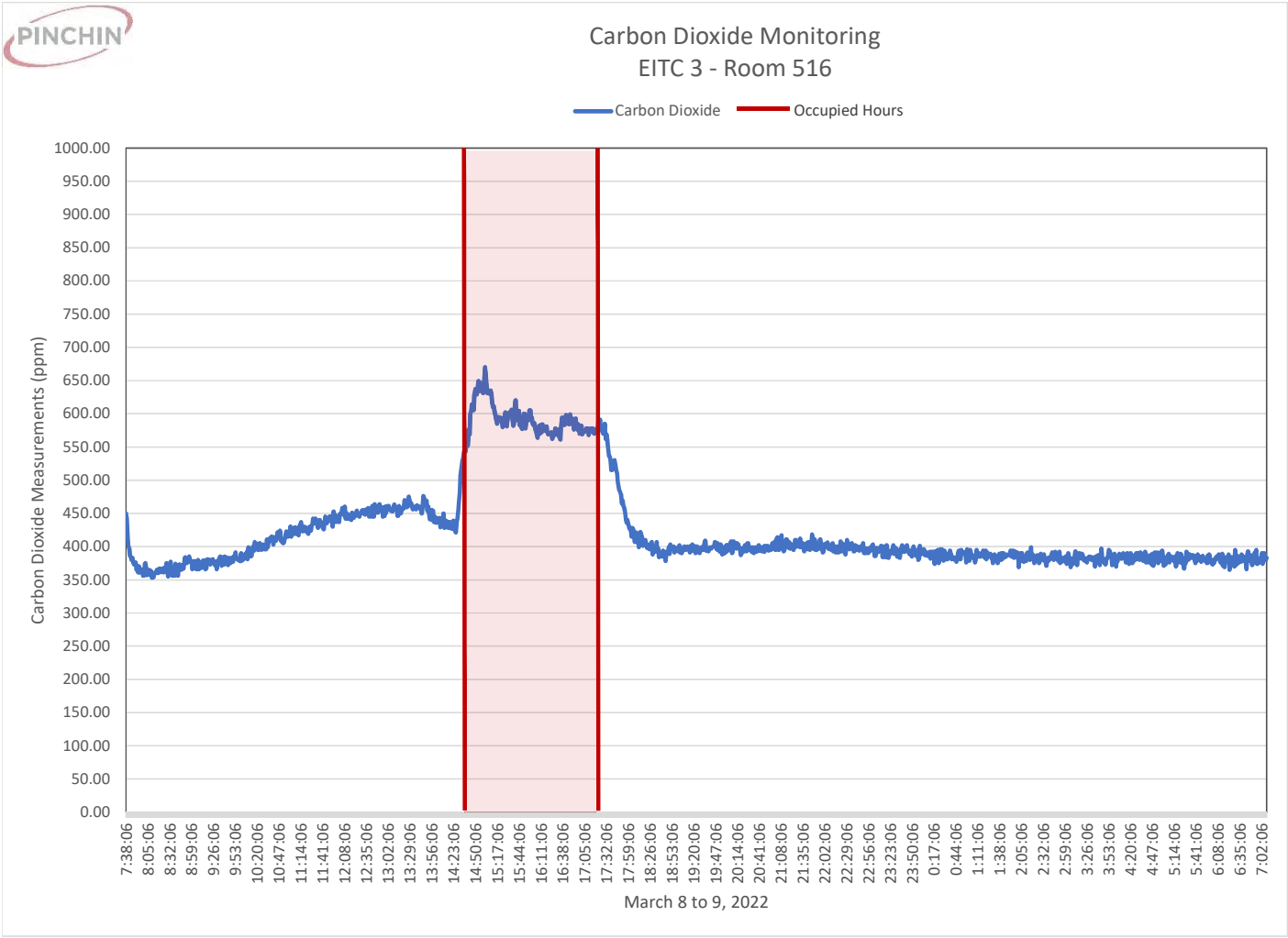
3/8/2022

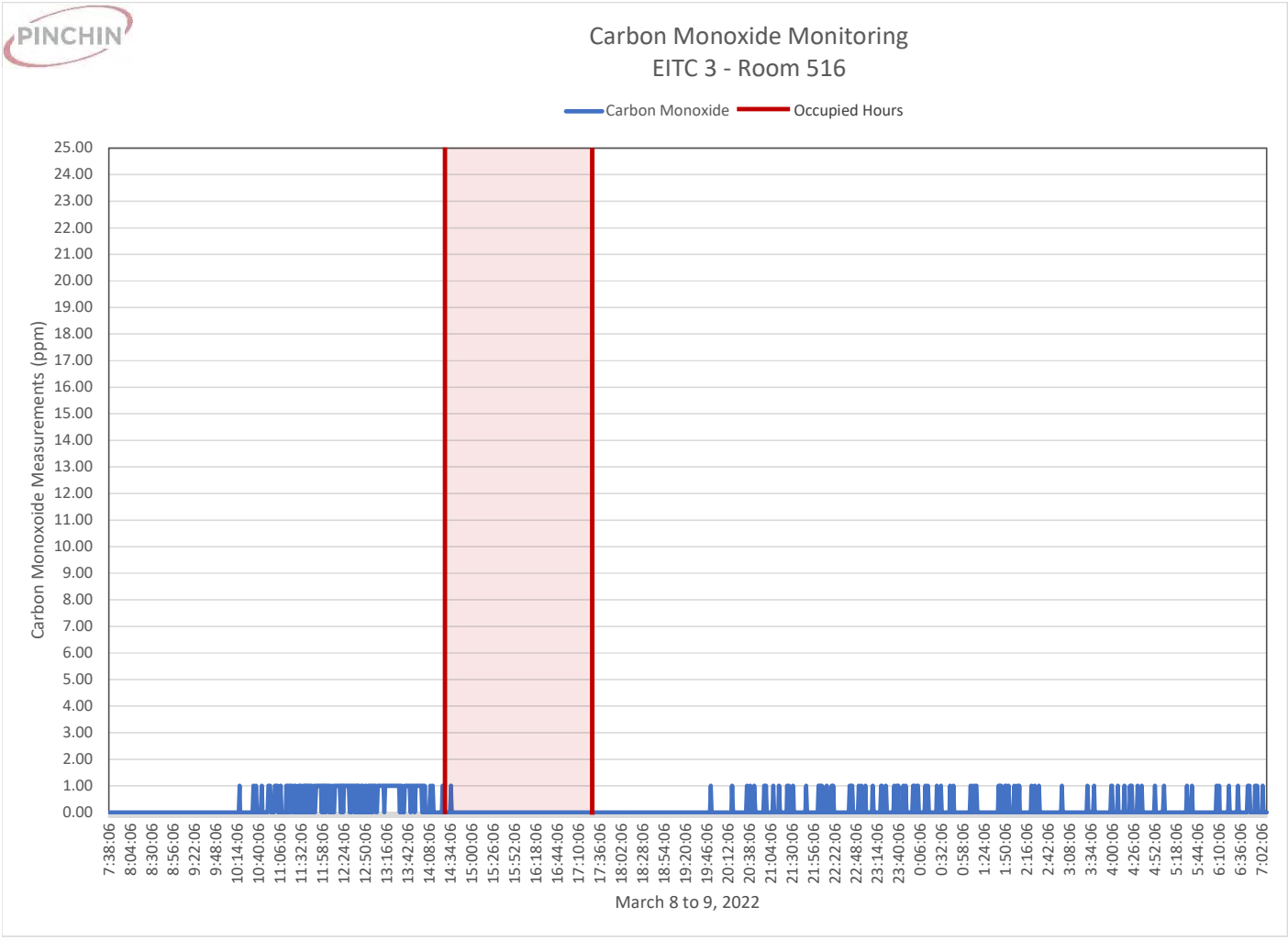
Datalog Period

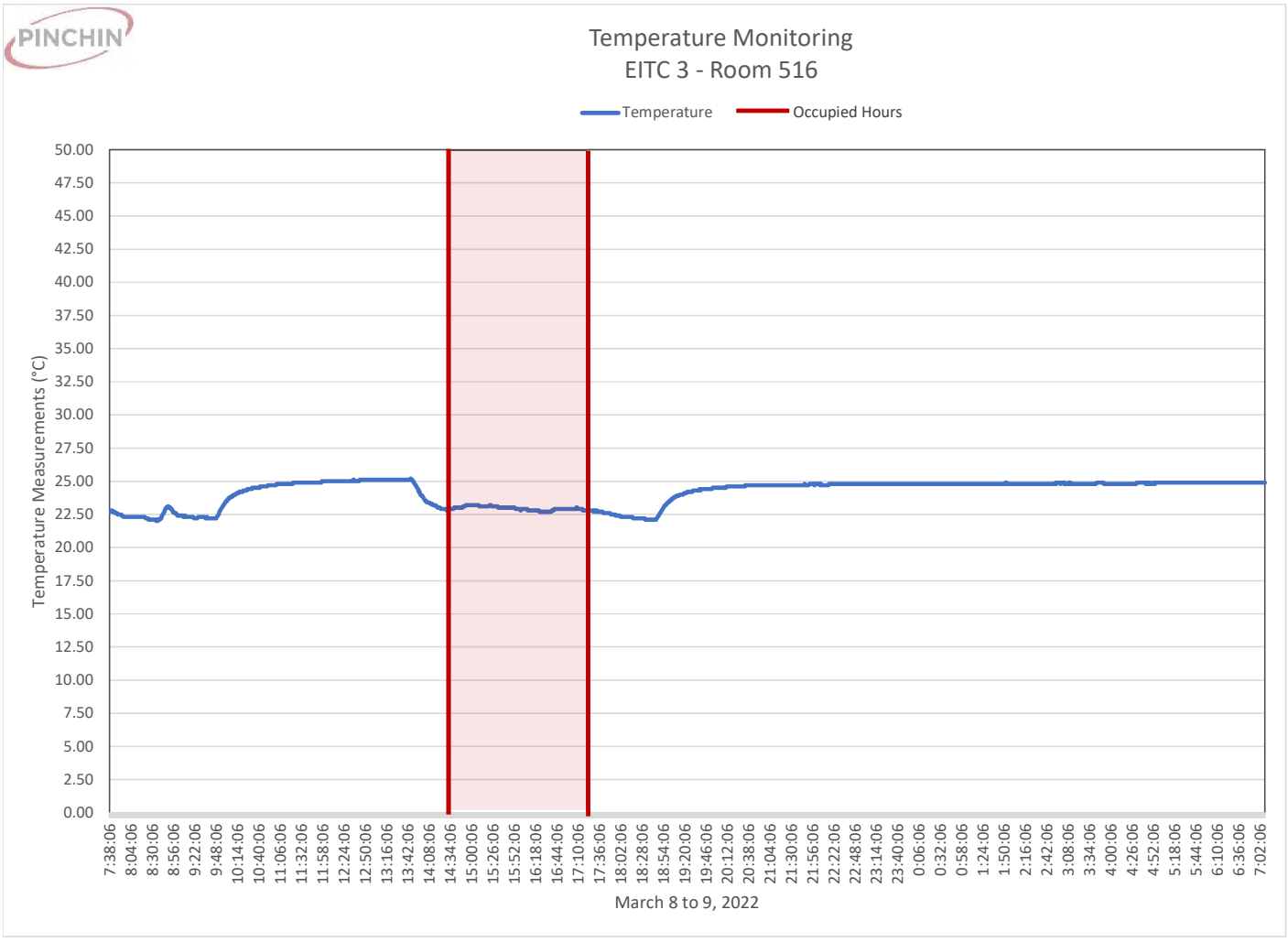
Device Name	EMP070003
Serial Number	EMP070003
Run Time	23:29:43
Start Time	3/8/2022 7:37:06 AM
Stop Time	3/9/2022 7:06:49 AM

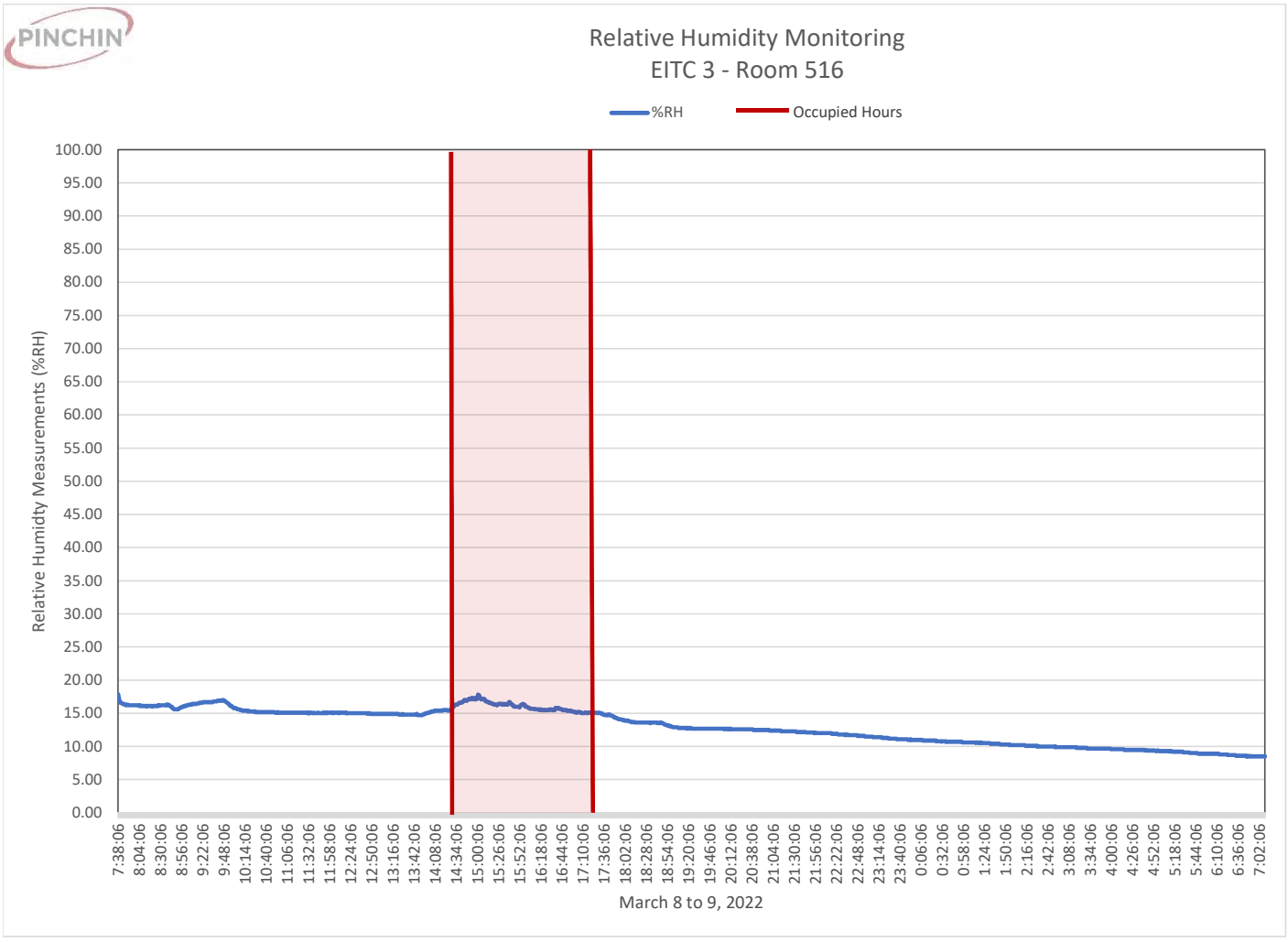
IAQ Data Summary

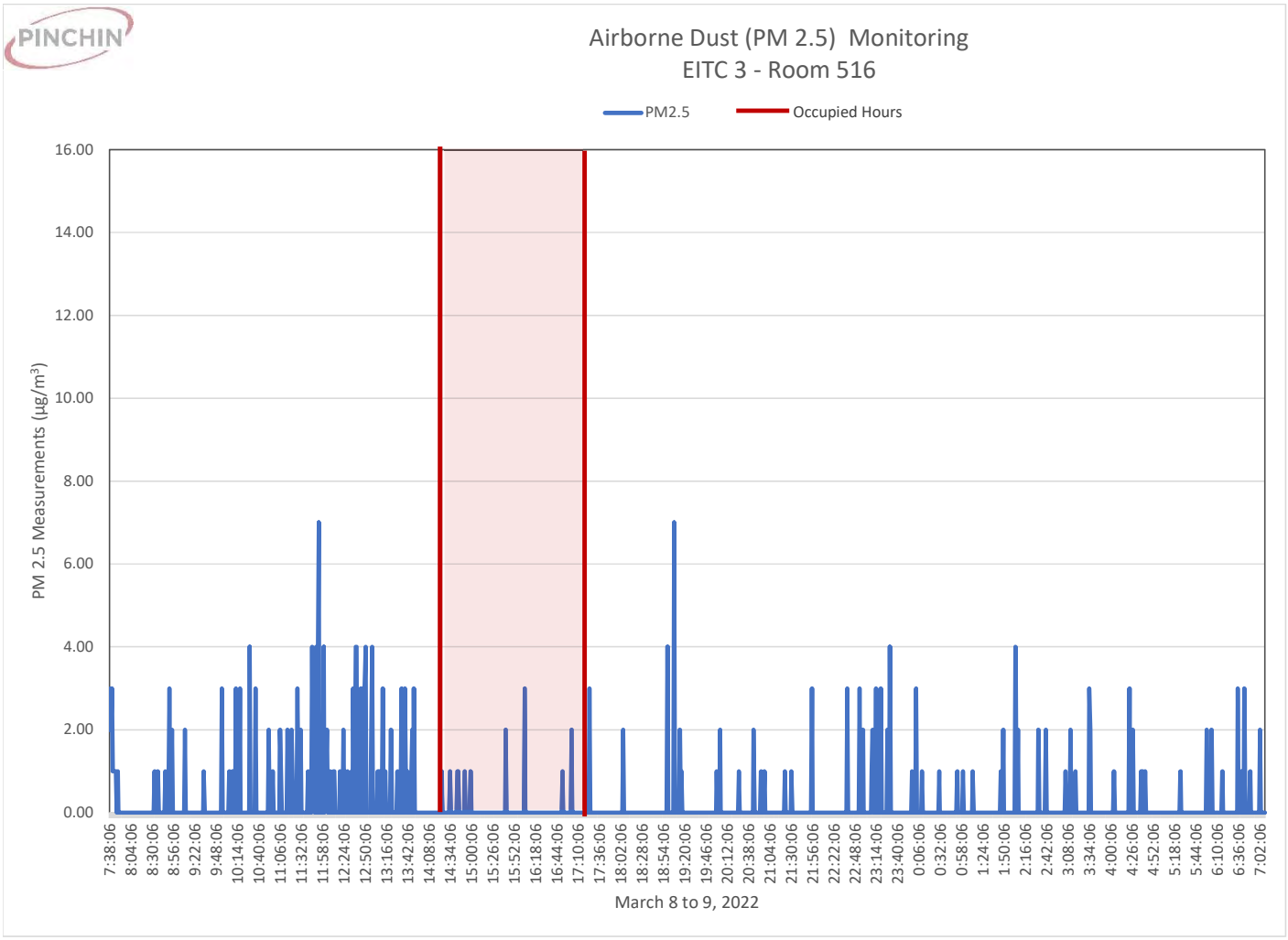
Description	Value	Description	Value
CO2Ave	425 PPM	CO2Max	675 PPM
CO2MaxTime	3/8/2022 3:01:33 PM	CO2Min	351 PPM
COAve	0 PPM	COMax	1 PPM
COMin	0 PPM	Dust Average	0.000 ug/m³
Dust Max	10.000 ug/m³	Dust Min	0.000 ug/m³
Humidity Avg	13.0 %	Humidity Max	19.4 %
Humidity Max Time	3/8/2022 7:37:06 AM	Humidity Min	8.5 %
Humidity Min Time	3/9/2022 7:06:21 AM	PIDAvePPB	Below the Detection Limit of the Instrument
PIDMaxPPB	Below the Detection Limit of the Instrument	PIDMinPPB	Below the Detection Limit of the Instrument
Temp Avg	24.1 °C	Temp Max Time	3/8/2022 1:45:57 PM
Temp Min Time	3/8/2022 8:35:13 AM	Temperature Max	25.2 °C
Temperature Min	22 °C		
Dust Impactor Setting	2.5 µm		

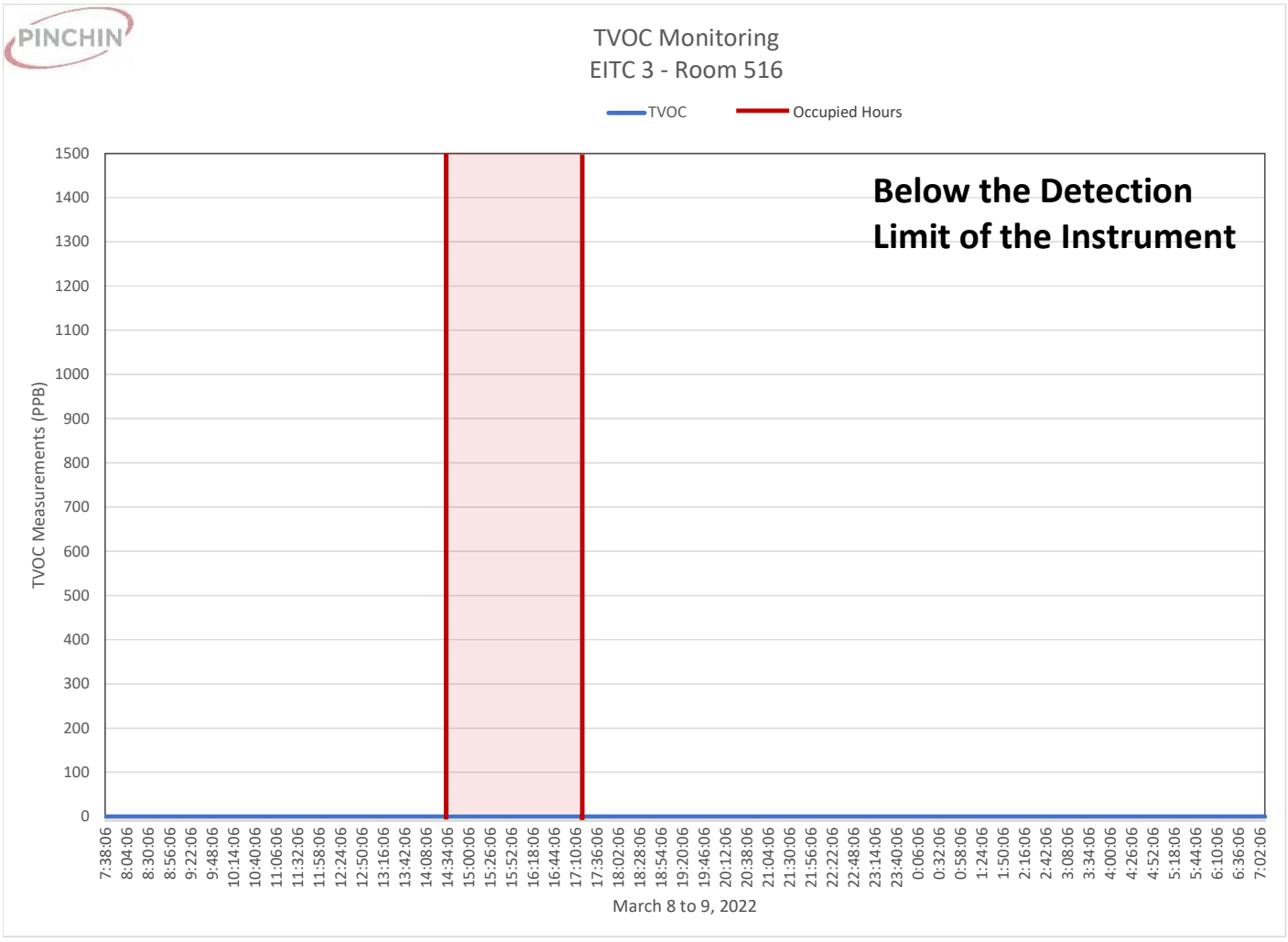

PINCHIN
Carbon Dioxide Monitoring
EITC 3 - Room 516
Carbon Dioxide
Occupied Hours
Carbon Dioxide Measurements (ppm)
1000.00
950.00
900.00
850.00
800.00
750.00
700.00
650.00
600.00
550.00
500.00
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
7:38:06
8:05:06
8:32:06
8:59:06
9:26:06
9:53:06
10:20:06
10:47:06
11:14:06
11:41:06
12:08:06
12:35:06
13:02:06
13:29:06
13:56:06
14:23:06
14:50:06
15:17:06
15:44:06
16:11:06
16:38:06
17:05:06
17:32:06
17:59:06
18:26:06
18:53:06
19:20:06
19:47:06
20:14:06
20:41:06
21:08:06
21:35:06
22:02:06
22:29:06
22:56:06
23:23:06
23:50:06
0:17:06
0:44:06
1:11:06
1:38:06
2:05:06
2:32:06
2:59:06
3:26:06
3:53:06
4:20:06
4:47:06
5:14:06
5:41:06
6:08:06
6:35:06
7:02:06
March 8 to 9, 2022


PINCHIN
Carbon Monoxide Monitoring
EITC 3 - Room 516
Carbon Monoxide
Occupied Hours
Carbon Monoxide Measurements (ppm)
25.00
24.00
23.00
22.00
21.00
20.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
7:38:06
8:04:06
8:30:06
8:56:06
9:22:06
9:48:06
10:14:06
10:40:06
11:06:06
11:32:06
11:58:06
12:24:06
12:50:06
13:16:06
13:42:06
14:08:06
14:34:06
15:00:06
15:26:06
15:52:06
16:18:06
16:44:06
17:10:06
17:36:06
18:02:06
18:28:06
18:54:06
19:20:06
19:46:06
20:12:06
20:38:06
21:04:06
21:30:06
21:56:06
22:22:06
22:48:06
23:14:06
23:40:06
0:06:06
0:32:06
0:58:06
1:24:06
1:50:06
2:16:06
2:42:06
3:08:06
3:34:06
4:00:06
4:26:06
4:52:06
5:18:06
5:44:06
6:10:06
6:36:06
7:02:06
March 8 to 9, 2022


PINCHIN
Temperature Monitoring
EITC 3 - Room 516
Temperature
Occupied Hours
Temperature Measurements (°C)
50.00
47.50
45.00
42.50
40.00
37.50
35.00
32.50
30.00
27.50
25.00
22.50
20.00
17.50
15.00
12.50
10.00
7.50
5.00
2.50
0.00
7:38:06
8:04:06
8:30:06
8:56:06
9:22:06
9:48:06
10:14:06
10:40:06
11:06:06
11:32:06
11:58:06
12:24:06
12:50:06
13:16:06
13:42:06
14:08:06
14:34:06
15:00:06
15:26:06
15:52:06
16:18:06
16:44:06
17:10:06
17:36:06
18:02:06
18:28:06
18:54:06
19:20:06
19:46:06
20:12:06
20:38:06
21:04:06
21:30:06
21:56:06
22:22:06
22:48:06
23:14:06
23:40:06
0:06:06
0:32:06
0:58:06
1:24:06
1:50:06
2:16:06
2:42:06
3:08:06
3:34:06
4:00:06
4:26:06
4:52:06
5:18:06
5:44:06
6:10:06
6:36:06
7:02:06
March 8 to 9, 2022


PINCHIN
Relative Humidity Monitoring
EITC 3 - Room 516
%RH
Occupied Hours
Relative Humidty Measurements (%RH)
100.00
95.00
90.00
85.00
80.00
75.00
70.00
65.00
60.00
55.00
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
7:38:06
8:04:06
8:30:06
8:56:06
9:22:06
9:48:06
10:14:06
10:40:06
11:06:06
11:32:06
11:58:06
12:24:06
12:50:06
13:16:06
13:42:06
14:08:06
14:34:06
15:00:06
15:26:06
15:52:06
16:18:06
16:44:06
17:10:06
17:36:06
18:02:06
18:28:06
18:54:06
19:20:06
19:46:06
20:12:06
20:38:06
21:04:06
21:30:06
21:56:06
22:22:06
22:48:06
23:14:06
23:40:06
0:06:06
0:32:06
0:58:06
1:24:06
1:50:06
2:16:06
2:42:06
3:08:06
3:34:06
4:00:06
4:26:06
4:52:06
5:18:06
5:44:06
6:10:06
6:36:06
7:02:06
March 8 to 9, 2022


PINCHIN
Airborne Dust (PM 2.5) Monitoring
EITC 3 - Room 516
PM2.5
Occupied Hours
PM 2.5 Measurements (µg/m³)
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
7:38:06
8:04:06
8:30:06
8:56:06
9:22:06
9:48:06
10:14:06
10:40:06
11:06:06
11:32:06
11:58:06
12:24:06
12:50:06
13:16:06
13:42:06
14:08:06
14:34:06
15:00:06
15:26:06
15:52:06
16:18:06
16:44:06
17:10:06
17:36:06
18:02:06
18:28:06
18:54:06
19:20:06
19:46:06
20:12:06
20:38:06
21:04:06
21:30:06
21:56:06
22:22:06
22:48:06
23:14:06
23:40:06
0:06:06
0:32:06
0:58:06
1:24:06
1:50:06
2:16:06
2:42:06
3:08:06
3:34:06
4:00:06
4:26:06
4:52:06
5:18:06
5:44:06
6:10:06
6:36:06
7:02:06
March 8 to 9, 2022


PINCHIN
TVOC Monitoring
EITC 3 - Room 516
TVOC
Occupied Hours
Below the Detection Limit of the Instrument
TVOC Measurements (PPB)
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
7:38:06
8:04:06
8:30:06
8:56:06
9:22:06
9:48:06
10:14:06
10:40:06
11:06:06
11:32:06
11:58:06
12:24:06
12:50:06
13:16:06
13:42:06
14:08:06
14:34:06
15:00:06
15:26:06
15:52:06
16:18:06
16:44:06
17:10:06
17:36:06
18:02:06
18:28:06
18:54:06
19:20:06
19:46:06
20:12:06
20:38:06
21:04:06
21:30:06
21:56:06
22:22:06
22:48:06
23:14:06
23:40:06
0:06:06
0:32:06
0:58:06
1:24:06
1:50:06
2:16:06
2:42:06
3:08:06
3:34:06
4:00:06
4:26:06
4:52:06
5:18:06
5:44:06
6:10:06
6:36:06
7:02:06
March 8 to 9, 2022

FINAL

Investigation of Indoor Air Quality

Helen Glass Building
89 Curry Place, Winnipeg, Manitoba

Prepared for:

University of Manitoba
120 Physical Plant,
89 Freedman Crescent
Winnipeg, Manitoba, R3T 2N2

March 31, 2022

Pinchin File: 306866

Issued to: **University of Manitoba**
Issued on: **March 31, 2022**
Pinchin File: **306866**
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EXECUTIVE SUMMARY

Pinchin Ltd. (Pinchin) was retained by University of Manitoba (the Client) to conduct an investigation of indoor air quality (IAQ) that included 24-hour monitoring. The work was conducted at 89 Curry Place, Winnipeg, Manitoba. Room 470 of the Helen Glass Building was the data logging location chosen by the client as it was occupied by staff and students during the hours of 8:30 am – 10:20 am, 11:00 am – 12:50 pm, and 1:30 pm – 3:20 pm. Room 470 is located on the 4th floor of the Helen Glass Building at the Fort Garry campus. The client also requested that in locations where the 24-hour monitoring occurred, observations be made specifically to the cleanliness of supply air diffusers and return air grilles. As well an inspection of the Heating Ventilation Air Conditioning (HVAC) system was requested to determine if there were conditions present that could degrade air quality, i.e., dirty or wrongly fitted filters, presence of moisture, etc.

The majority of the indoor air quality measurements collected were within recommended ranges and meet the criteria of the referenced guidelines. Carbon dioxide concentrations suggested adequate ventilation. Carbon monoxide concentrations did not suggest the presence of exhaust or combustion gases. Temperature measurements were within the recommended comfort ranges for office environments. $PM_{2.5}$ concentrations are within typical ranges. The Pinchin inspector did not identify any deficiencies with regards to unusual odours during the investigation.

Relative humidity measurements were below the recommended comfort range which may result in dry skin, eye and nose irritation. However, it should be noted that low relative humidity is a common wintertime condition in Canada.

Total volatile organic compound average levels were above the recommended range in room 470 during the occupied time. The higher TVOC concentrations could be caused by the use and presence of such things as hand sanitizers. Hand sanitizers were noted to be present at the time of monitor set up.

Pinchin inspected the Air Handling Units (AHUs) and indicated that the AHUs were found in good condition with no leaks or standing water build up. The filters in AHU 1 and 2 indicated normal dirt build up. Slightly loaded filters can tend to increase the efficiency of the filter capture. As result of this observation, there would be no action required for changing out the filters.

The following recommendations are offered to improve air quality in this building:

1. Communicate the findings of this report to the staff, and health and safety representative;
2. Review the humidification system in the building to ensure it is operational and functioning properly. Consider making adjustments as necessary;

3. Consider increasing the amount of outdoor air being supplied to the floor, while minimizing the amount of return air being recirculated into to the lab to help dissipate the elevated TVOCs concentrations in room 470; and
4. Determine the cause for the elevated Total Volatile Compound (TVOC) readings and consider re-testing when the cause has been mitigated.

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1.0 INTRODUCTION AND SCOPE

1.1 Statement of Understanding

Pinchin Ltd. (Pinchin) was retained by University of Manitoba (the Client) to conduct an investigation of Indoor Air Quality (IAQ) that included 24-hour monitoring. The work was conducted at 89 Curry Place, Winnipeg, Manitoba. Room 470 of the Helen Glass Building was the data logging location chosen by the client as it was fully occupied by staff and students throughout the daytime hours. Room 470 is located on the 4th floor of the Helen Glass Building at the Fort Garry campus. The client also requested that in locations where the 24-hour monitoring occurred, observations be made specifically to the cleanliness of supply air diffusers and return air grilles. As well an inspection of the Heating Ventilation Air Conditioning (HVAC) system was requested.

1.2 Scope of Work

Pinchin performed the investigation from March 9 to March 10, 2022. The scope of this investigation was limited to Room 470. As well as the HVAC system on the 100 Floor Level.

The investigation involved the following activities:

- Review site via in-person walkthrough for factors that could contribute to poor indoor air quality;
- Site review of HVAC equipment servicing the entire building; and
- Data-logging of Carbon Dioxide (CO_2), Carbon Monoxide (CO), Temperature (Temp), Relative Humidity (RH), Total Volatile Organic Compounds (TVOCs) and Particulate Matter smaller than 2.5 micrometres ($PM_{2.5}$) within Room 470.

2.0 METHODOLOGY

2.1 Interviews and Site Reviews

Pinchin interviewed the University of Manitoba Physical Plant, Project and Building Managers to discuss the history of the building, maintenance practices and any indoor air quality concerns.

The investigator did not perform any destructive work to inspect concealed conditions inside wall and/or ceiling cavities.

2.2 Test Methods and Criteria

The following table presents the parameters measured in this investigation, the instruments and sampling/analytical methods used, the applicable units of measurement, and the Indoor Air Quality criteria used for the evaluation of the results.

Table I – IAQ Parameters Tested, Measurement Criteria and Instruments

Parameter	Unit of Measurement	Recommended Limit	Instrumentation
Carbon dioxide, CO_2	Parts per million in air (ppm)	Outdoor Air (ppm) + 700 ppm [1]	24-hour Data-log Monitoring using a 3M® EVM-7 Air Quality Monitor
Carbon monoxide, CO	ppm	5 ppm [2]	
Temperature, T	°C	21 to 25°C, winter clothing [3]	
Relative Humidity, RH	% RH	25[4] to 65%[5], for occupant comfort	
Total Volatile Organic Compounds, (TVOC)	Parts per billion (ppb)	400 ppb[6]	
Particulate Matter smaller than 2.5 micrometres, $PM_{2.5}$	µg/m³	25 µg/m³ [7]24-hour mean;	

All data-logging direct-reading instruments were calibrated before use.

3.0 FINDINGS

3.1 Results of Interviews

Project or Building Manager reported the following:

- Air Handling Units (AHU) filters are changed every three months or as needed;
- The occupant capacity within Room 470 is 40 people; and
- The enrollment/class ranges from 10 to 21 people.

1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Ventilation for Acceptable Indoor Air Quality* [ANSI/ASHRAE Standard 62.1-2019]. Atlanta, GA: ASHRAE, 2019.
2 Health Canada: *Indoor Air Quality in Office Buildings: A Technical Guide*. Ottawa, ON: Health Canada, 1995.
3 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Thermal Environmental Conditions for Human Occupancy* [ANSI/ASHRAE Standard 55-2020]. Atlanta, GA: ASHRAE, 2020.
4 L.E. Burton, J.G. Girman, S.E. Womble: Airborne particulate matter within 100 randomly selected office buildings in the United States (BASE). Proceedings of Healthy Buildings 2000, Vol. 1 (2001).
5 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Thermal Environmental Conditions for Human Occupancy* [ANSI/ASHRAE Standard 55-2020]. Atlanta, GA:ASHRAE, 2020.
6 Value calculated from: US Environmental Protection Agency (EPA) "Building Assessment Survey and Evaluation (BASE) Study [Online] (Accessed August 25, 2014).
7 W. Team, "WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide : global update 2005 : summary of risk assessment", Apps.who.int, 2021. [Online]. Available: http://apps.who.int/iris/handle/10665/69477 [Accessed: 15-Sep- 2021].

3.2 Facility Description

Table II – Facility Description

Item	Details
Construction Date	1999
Number of Floors	Three floors above grade, one floor below grade
Structural Type	Steel
Foundation Type	Concrete
Exterior Cladding	Brick
HVAC	Forced air
Roof	Built up
Flooring	Vinyl sheet flooring
Interior Walls	Drywall
Ceilings	Acoustic ceiling tile

3.3 Results of Site Reviews

Appendix I presents the drawings.

There are two Air Handling Units within Helen Glass Building. AHU 1 provides conditioned air to the West Side of the building (Photo #1). Inside the AHU there were no leaks found or standing water (Photo #2), the filters fit properly and were observed to be clean (Photo #3). The condensate drain was free from any leaks or standing water (Photo #4).

AHU 2 provides conditioned air to the East Side of the building. Inside the AHU there were no leaks found or standing water (Photo #5), the filters fit properly and were observed to be clean (Photo #6). The condensate drain was free from any leaks or standing water (Photo #7).

In the sampling location there were observed to be 8 supply diffusers (Photo #8) and 2 return grates (Photo #9). All supply diffusers and return grates are clean and free from obstructions.

The filters in AHU 1 and AHU 2 are Minimum Efficiency Reporting Value (MERV) of 8.

Refer to Table II for photographs from the investigation.

Table III – Photographs from Investigation

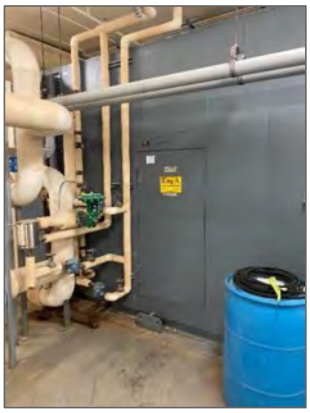


Photo 1 - AHU 1

Photo 2 - Inside AHU 1 free from leaks and standing water

Photo 3 - AHU 1 filters (clean)

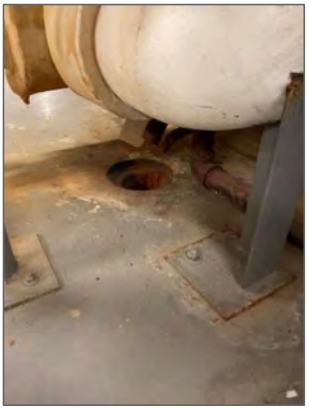


Photo 4 - AHU 1 condensate drain free from leaks and standing water

Photo 5 - Inside AHU 2 free from leaks and standing water

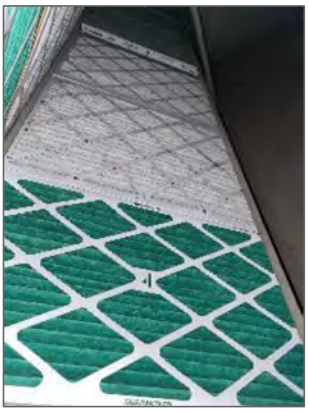


Photo 6 - AHU 2 filters (clean)

Table III – Photographs from Investigation

Photo 7 - AHU 2 condensate drain free from leaks and standing water

Photo 8 - Room 470 supply diffuser

Photo 9 - Room 470 Return grate

3.4 Results of Indoor Air Quality Tests

Appendix II presents the results of data-logging for IAQ parameters.

The EVM 7 air monitor was used for 24-hour data logging within Room 470, of $PM_{2.5}$, CO_2, CO, TVOC, Temperature, and Relative Humidity. The EVM-7 is a direct-reading instrument and was calibrated before use.

3.4.1 Carbon Dioxide (CO_2)

The 24-hour minimum CO_2 concentration recorded within the building was 360 ppm, the maximum CO_2 concentration was 780 ppm. The 24-hour average for CO_2 was 463 ppm. The average CO_2 concentration during **the occupied time** was 647 ppm. On March 9 and March 10 outdoor spot measurements were recorded. The average outdoor CO2 spot measurements for the two days was 427 ppm . The indoor carbon dioxide concentrations were below the limit of 1,127 ppm (427 ppm outdoors plus 700 ppm) recommended by American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) This indicates that the volume of the supply air was adequate for the occupancy loading at the time of the investigation.

3.4.2 Carbon Monoxide (CO)

The carbon monoxide concentrations were non-detectable or just at the detection limit of the instrumentation for the duration of the 24-hour datalogging. Health Canada advises that the detection of carbon monoxide above 5 ppm indicates a concern requiring further investigation.

3.4.3 Temperature (Temp)

The 24-hour minimum temperature measurement was 20.3 °C, the maximum temperature measurement was 24.6 °C. The 24-hour average temperature measurement was 24.0 °C. The average temperature measurement during **the occupied time** was 23.5 °C. On March 9 and March 10 outdoor spot measurements were taken each day, averaging -19.5 °C for these dates. The indoor temperatures were within the recommended comfort ranges for office environments for typical dress during winter conditions, of 21 to 25 °C.

3.4.4 Relative Humidity (RH)

The 24-hour minimum Relative Humidity measurement was 2.8 %RH, the maximum measurement was 10.1 %RH. The 24-hour average measurement for relative humidity was 4.9 %RH. The average relative humidity measurement during **the occupied time** was 7.31 %RH. On March 9 and March 10 outdoor spot measurements were taken each day, averaging 64 %RH for these dates. Relative humidity below 25 %RH may result in complaints of dry skin and eye and nose irritation. Low relative humidity is a common winter time condition in Canada due to difficulties maintaining proper humidification.

3.4.5 *Airborne Dust ($PM_{2.5}$)*

The 24-hour minimum concentration for $PM_{2.5}$ was below the detection limit of the monitoring instrument, the maximum concentration for $PM_{2.5}$ was 7 µg/m³. The 24-hour average concentration for $PM_{2.5}$ was 1 µg/m³. The average $PM_{2.5}$ concentrations during the occupied time was 1 µg/m³. On March 9 and March 10 outdoor spot measurements were taken each day, averaging 26 µg/m³ for these dates. For reference, World Health Organization (WHO) provides a guideline of 25 µg/m³ over a 24-hour period. The indoor $PM_{2.5}$ concentrations in this building were within the recommended range.

3.4.6 *Total Volatile Organic Compounds (TVOC)*

The 24- hour minimum concentration for TVOC was below the detection limits of the monitoring instrument, the maximum was 3400 ppb. The 24-hour average for TVOCs was 604 ppb. The average TVOC concentrations during **the occupied time** was 1696 ppb. On March 9 and March 10 outdoor spot measurements were taken and recorded as below the detection limit of the monitoring instrument. Based on US EPA research, office environments with TVOC concentrations up to 400 ppb would be at little risk of IAQ concern. As this is a guideline, complaints might be expected if concentrations were significantly above 400 ppb.

Table IV – Summary of 24-Hour Data-logging IAQ based on Indoor Air Quality Measurement Criteria

Parameter	Measurement Average	Indoor Air Quality Measurement Criteria	Below Indoor Air Quality Measurement Criteria?
Carbon Dioxide	463 ppm	Outdoor Air (ppm) + 700 ppm	Yes
Carbon Monoxide	0 ppm	5 ppm	Yes
Temperature (°C)	24 °C	21 to 25 °C, winter clothing	Yes
Relative Humidity (%)	4.9% RH	25 to 65%, for occupant comfort	No
$PM_{2.5}$	1 µg/m³	25 µg/m³	Yes
TVOC	604 ppb	400 ppb	No

4.0 DISCUSSION

The majority of the indoor air quality measurements collected were within recommended ranges and meet the criteria of the referenced guidelines. Carbon dioxide concentrations suggested adequate ventilation. Carbon monoxide concentrations did not suggest the presence of exhaust or combustion gases. Temperature measurements were within the recommended comfort ranges for office environments. $PM_{2.5}$ concentrations were within typical ranges. The Pinchin inspector did not identify any deficiencies with regards to unusual odours during the investigation.

Relative humidity measurements were below the recommended comfort range which may result in dry skin, eye and nose irritation. However, it should be noted that low relative humidity is a common wintertime condition in Canada.

Total volatile organic compound average levels were above the recommended range in room 470 during the occupied time. High TVOC concentrations can be caused when hand sanitizers get used in a space. It should be noted that hand sanitizers were present in the location of the sampling.

Pinchin inspected the Air Handling Units (AHUs) and indicated that the AHUs were found in good condition with no leaks or standing water build up. The filters in AHU 1 and 2 indicated normal dirt build up. Slightly loaded filters can tend to increase the efficiency of the filter capture. As result of this observation, there would be no action required for changing out the filters.

5.0 RECOMMENDATIONS

The following recommendations are offered to improve air quality in this building:

1. Communicate the findings of this report to the staff, and health and safety representative;
2. Review the humidification system in the building to ensure it is operational and functioning properly. Consider making adjustments as necessary;
3. Consider increasing the amount of outdoor air being supplied to the floor, while minimizing the amount of return air being recirculated into to the lab to help dissipate the elevated TVOCs concentrations in room 470; and
4. Determine the cause for the elevated Total Volatile Compound (TVOC) readings and consider re-testing when the cause has been mitigated.

6.0 TERMS AND LIMITATIONS

This work was performed subject to the Terms and Limitations presented or referenced in the proposal for this project.

Information provided by Pinchin is intended for Client use only. Pinchin will not provide results or information to any party unless disclosure by Pinchin is required by law. Any use by a third party of reports or documents authored by Pinchin or any reliance by a third party on or decisions made by a third party based on the findings described in said documents, is the sole responsibility of such third parties. Pinchin accepts no responsibility for damages suffered by any third party as a result of decisions made or actions conducted. No other warranties are implied or expressed.

\\pinchin.com\wpg\Job\306000s\0306866.000 UofM,89FREEDMAN,IAQ,ASSMNT\Deliverables\Helen Glass\306866.000 Final IAQ Report, Helen Glass, 89 Curry Pl, Wpg, MB, UofM, Mar 31, 2022.docx

Template: Master Report Investigation of IAQ, IEQ, September 15, 2021

APPENDIX I

Drawings


N
LEGEND
DATA LOGGING LOCATION
BASE PLAN PROVIDED BY CLIENT.
PINCHIN
PROJECT NAME:
INDOOR AIR QUALITY ASSESSMENT
CLIENT NAME:
UNIVERSITY OF MANITOBA
HELEN GLASS
PROJECT LOCATION:
99 CURRY PLACE
WINNIPEG, MANITOBA
FIGURE NAME:
LEVEL 400
PROJECT NUMBER:
306866
SCALE:
NOT TO SCALE
DRAWN BY:
CE
REVIEWED BY:
JB
DATE:
2022/03/16
FIGURE NUMBER:
1 OF 1

APPENDIX II

Results of Data-Logging Indoor Air Quality Measurements

Session Report
89 Curry Place

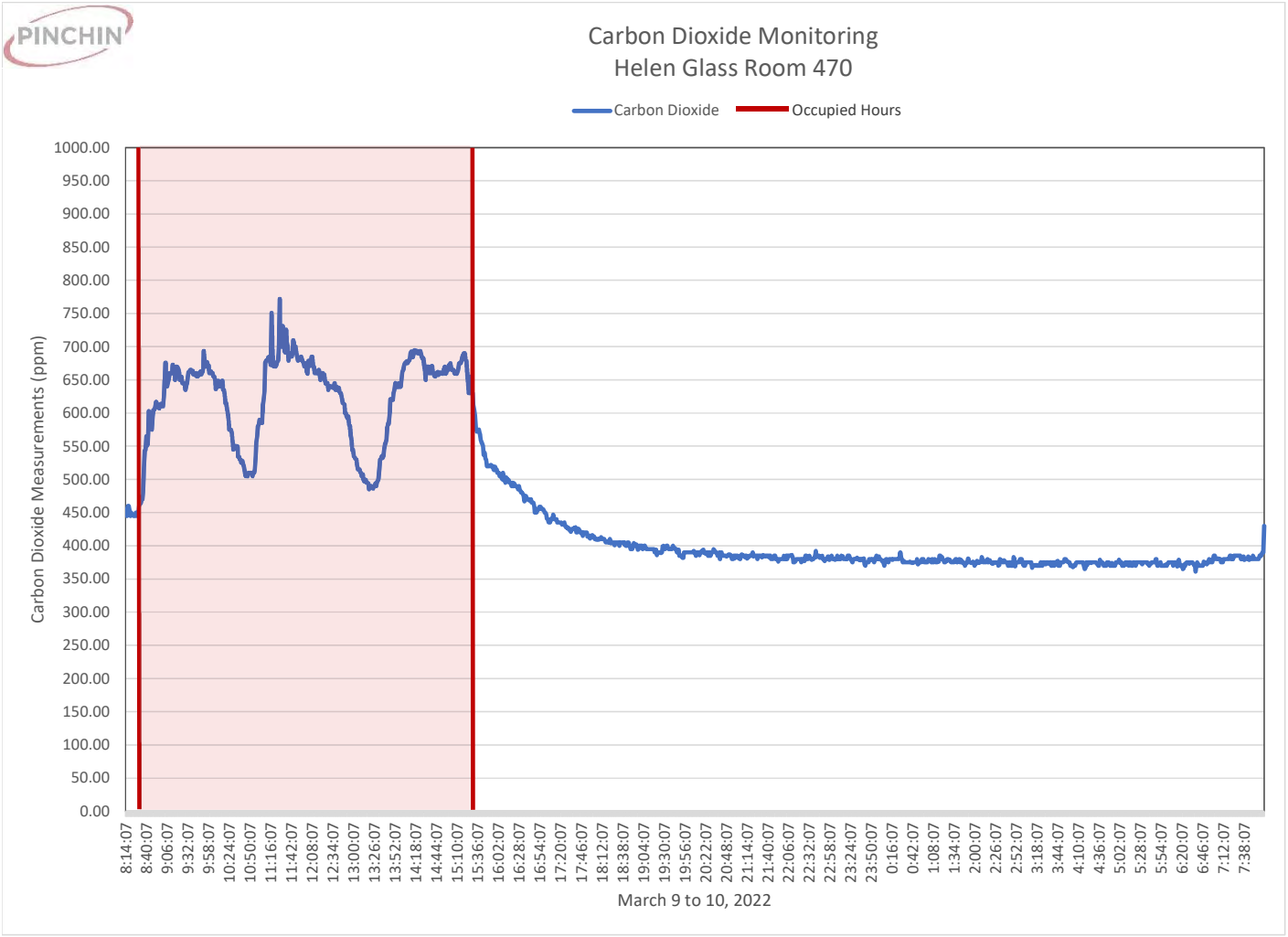
3/9/2022

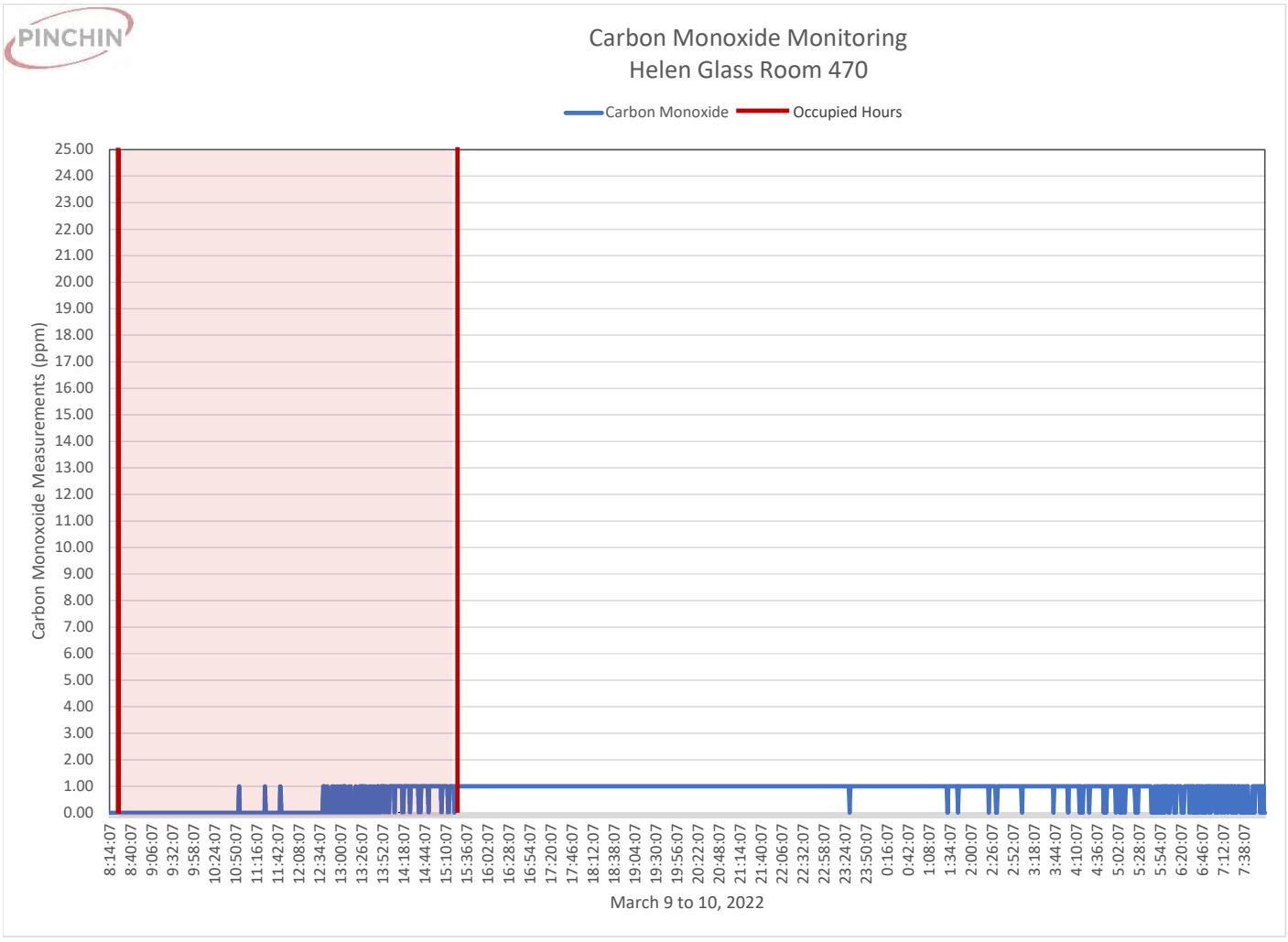
Datalog Period

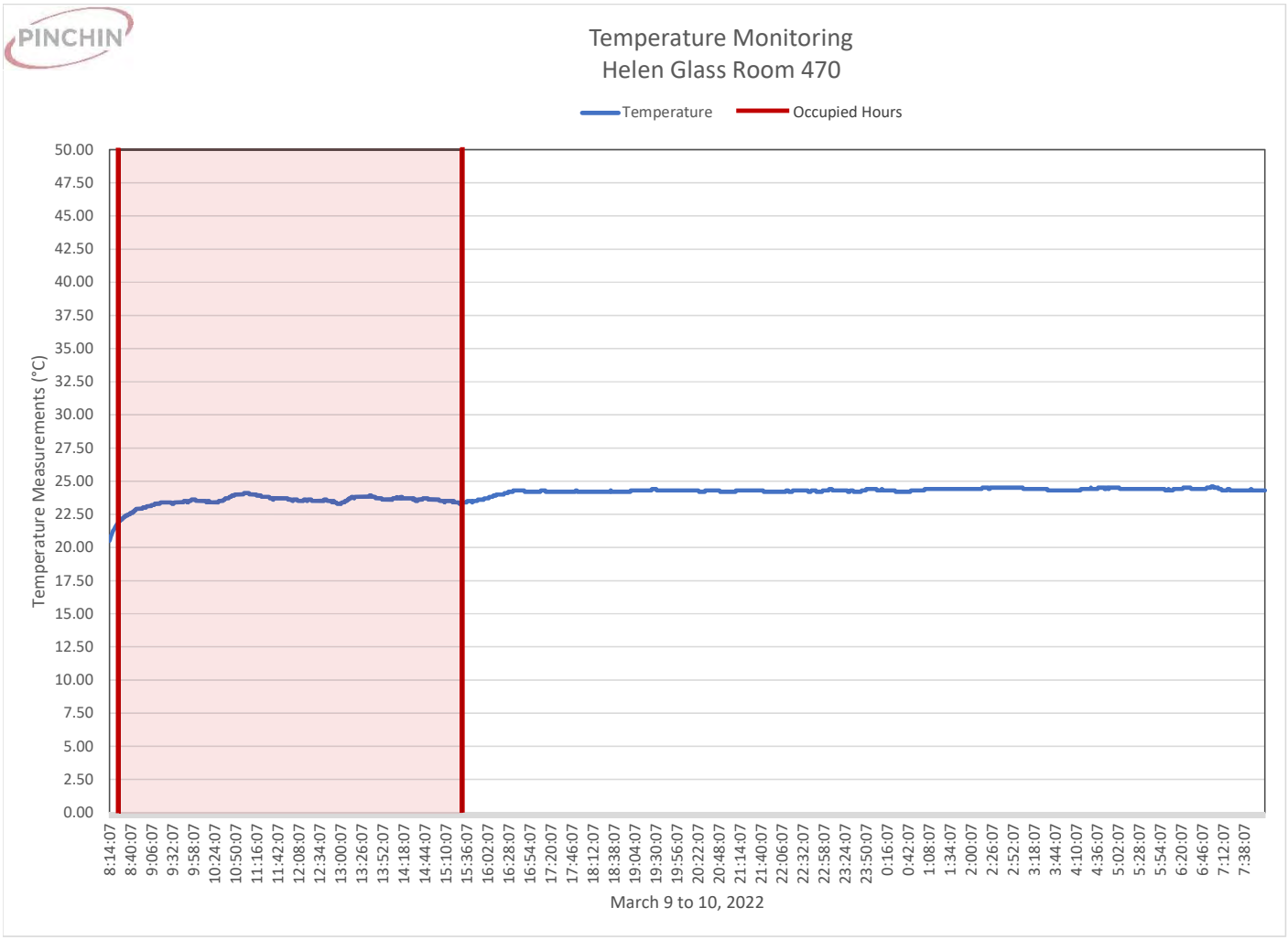
Device Name	EML060008
Serial Number	EML060008
Run Time	23:48:20
Start Time	3/9/2022 8:13:07 AM
Stop Time	3/10/2022 8:01:27 AM

IAQ Data Summary

Description	Value	Description	Value
CO2Ave	463 PPM	CO2Max	780 PPM
CO2MaxTime	3/9/2022 11:27:14 AM	CO2Min	360 PPM
COAve	1 PPM	COMax	1 PPM
COMin	0 PPM	Dust Average	1.000 ug/m³
Dust Max	7.000 ug/m³	Dust Min	0.000 ug/m³
Humidity Avg	4.9 %	Humidity Max	10.1 %
Humidity Max Time	3/9/2022 8:13:13 AM	Humidity Min	2.8 %
Humidity Min Time	3/10/2022 6:27:07 AM	PIDAvePPB	604 ppb
PIDMaxPPB	3400 ppb	PIDMinPPB	0 ppb
Temp Avg	24 °C	Temp Max Time	3/10/2022 6:58:59 AM
Temp Min Time	3/9/2022 8:13:07 AM	Temperature Max	24.6 °C
Temperature Min	20.3 °C		
Dust Impactor Setting	2.5 µm		


PINCHIN
Carbon Dioxide Monitoring
Helen Glass Room 470
Carbon Dioxide
Occupied Hours
Carbon Dioxide Measurements (ppm)
1000.00
950.00
900.00
850.00
800.00
750.00
700.00
650.00
600.00
550.00
500.00
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
8:14:07
8:40:07
9:06:07
9:32:07
9:58:07
10:24:07
10:50:07
11:16:07
11:42:07
12:08:07
12:34:07
13:00:07
13:26:07
13:52:07
14:18:07
14:44:07
15:10:07
15:36:07
16:02:07
16:28:07
16:54:07
17:20:07
17:46:07
18:12:07
18:38:07
19:04:07
19:30:07
19:56:07
20:22:07
20:48:07
21:14:07
21:40:07
22:06:07
22:32:07
22:58:07
23:24:07
23:50:07
0:16:07
0:42:07
1:08:07
1:34:07
2:00:07
2:26:07
2:52:07
3:18:07
3:44:07
4:10:07
4:36:07
5:02:07
5:28:07
5:54:07
6:20:07
6:46:07
7:12:07
7:38:07
March 9 to 10, 2022


PINCHIN
Carbon Monoxide Monitoring
Helen Glass Room 470
Carbon Monoxide
Occupied Hours
Carbon Monoxide Measurements (ppm)
25.00
24.00
23.00
22.00
21.00
20.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
8:14:07
8:40:07
9:06:07
9:32:07
9:58:07
10:24:07
10:50:07
11:16:07
11:42:07
12:08:07
12:34:07
13:00:07
13:26:07
13:52:07
14:18:07
14:44:07
15:10:07
15:36:07
16:02:07
16:28:07
16:54:07
17:20:07
17:46:07
18:12:07
18:38:07
19:04:07
19:30:07
19:56:07
20:22:07
20:48:07
21:14:07
21:40:07
22:06:07
22:32:07
22:58:07
23:24:07
23:50:07
0:16:07
0:42:07
1:08:07
1:34:07
2:00:07
2:26:07
2:52:07
3:18:07
3:44:07
4:10:07
4:36:07
5:02:07
5:28:07
5:54:07
6:20:07
6:46:07
7:12:07
7:38:07
March 9 to 10, 2022


PINCHIN
Temperature Monitoring
Helen Glass Room 470
Temperature
Occupied Hours
Temperature Measurements (°C)
50.00
47.50
45.00
42.50
40.00
37.50
35.00
32.50
30.00
27.50
25.00
22.50
20.00
17.50
15.00
12.50
10.00
7.50
5.00
2.50
0.00
8:14:07
8:40:07
9:06:07
9:32:07
9:58:07
10:24:07
10:50:07
11:16:07
11:42:07
12:08:07
12:34:07
13:00:07
13:26:07
13:52:07
14:18:07
14:44:07
15:10:07
15:36:07
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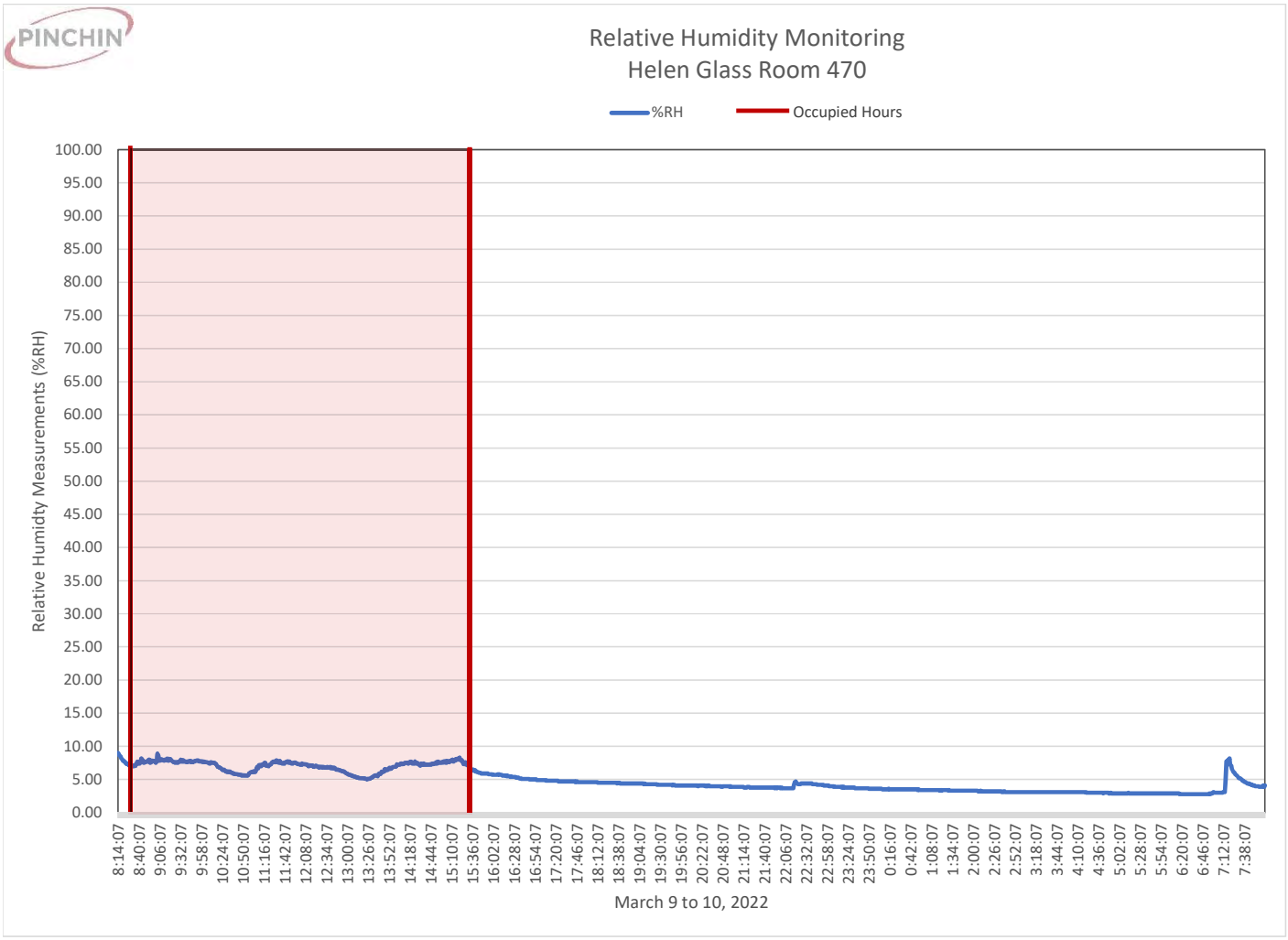
4:10:07
4:36:07
5:02:07
5:28:07
5:54:07
6:20:07
6:46:07
7:12:07
7:38:07
March 9 to 10, 2022


PINCHIN
Relative Humidity Monitoring
Helen Glass Room 470
%RH
Occupied Hours
Relative Humidty Measurements (%RH)
100.00
95.00
90.00
85.00
80.00
75.00
70.00
65.00
60.00
55.00
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
8:14:07
8:40:07
9:06:07
9:32:07
9:58:07
10:24:07
10:50:07
11:16:07
11:42:07
12:08:07
12:34:07
13:00:07
13:26:07
13:52:07
14:18:07
14:44:07
15:10:07
15:36:07
16:02:07
16:28:07
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3:18:07
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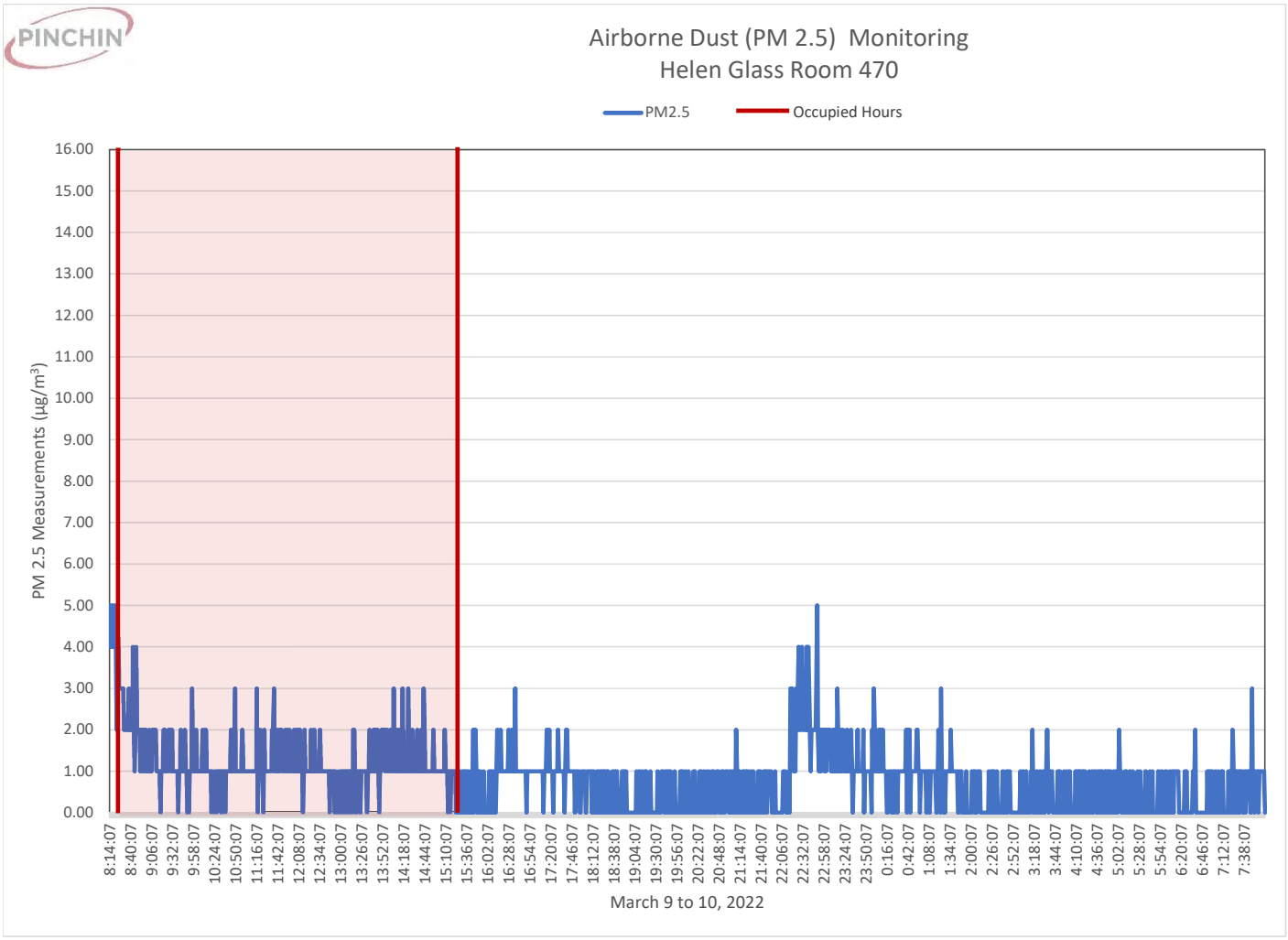
4:10:07
4:36:07
5:02:07
5:28:07
5:54:07
6:20:07
6:46:07
7:12:07
7:38:07
March 9 to 10, 2022


PINCHIN
Airborne Dust (PM 2.5) Monitoring
Helen Glass Room 470
PM2.5
Occupied Hours
PM 2.5 Measurements (µg/m³)
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
8:14:07
8:40:07
9:06:07
9:32:07
9:58:07
10:24:07
10:50:07
11:16:07
11:42:07
12:08:07
12:34:07
13:00:07
13:26:07
13:52:07
14:18:07
14:44:07
15:10:07
15:36:07
16:02:07
16:28:07
16:54:07
17:20:07
17:46:07
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4:36:07
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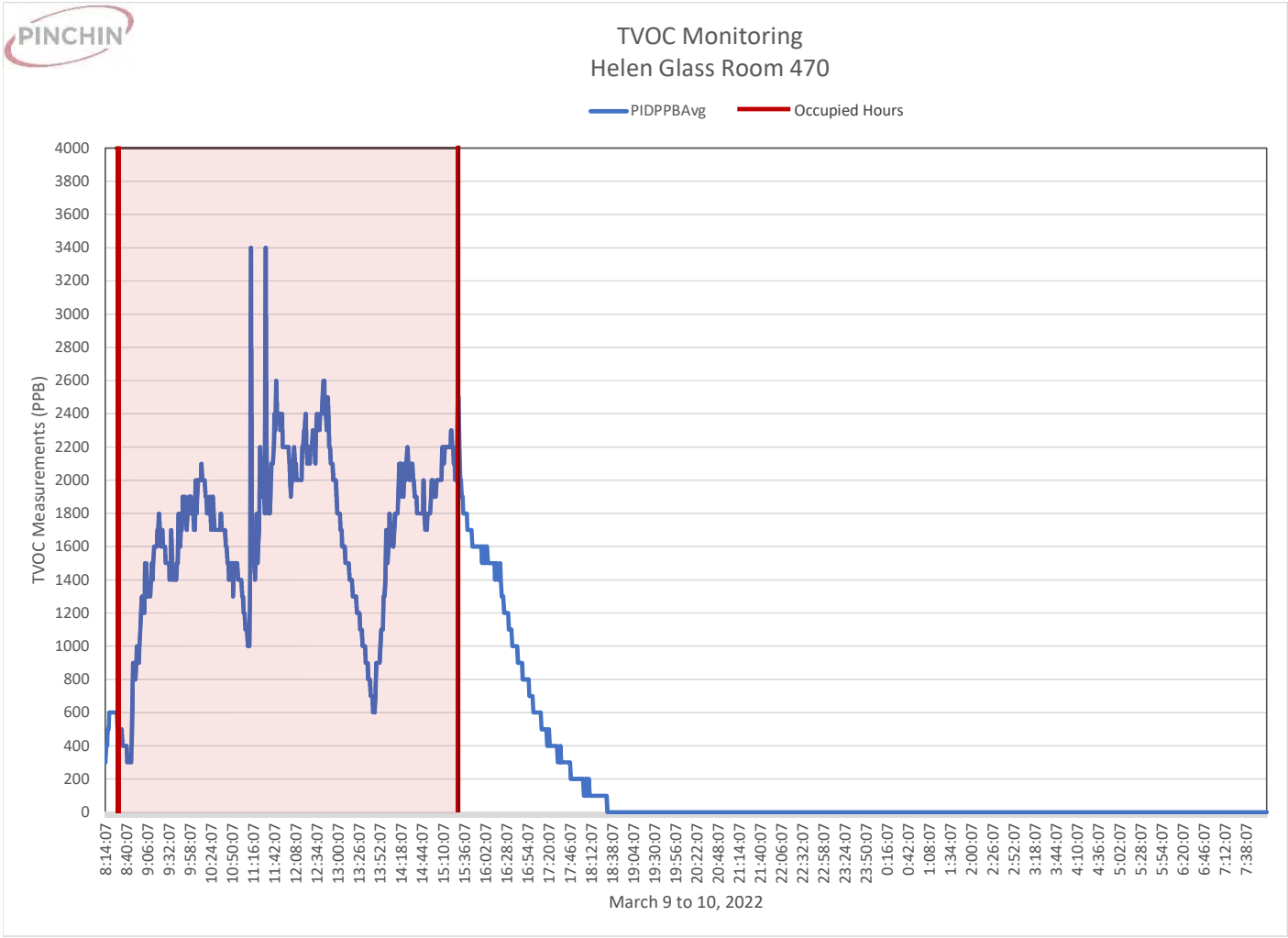
7:38:07
March 9 to 10, 2022


PINCHIN
TVOC Monitoring
Helen Glass Room 470
PIDPPBAvg
Occupied Hours
TVOC Measurements (PPB)
4000
3800
3600
3400
3200
3000
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
8:14:07
8:40:07
9:06:07
9:32:07
9:58:07
10:24:07
10:50:07
11:16:07
11:42:07
12:08:07
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4:36:07
5:02:07
5:28:07
5:54:07
6:20:07
6:46:07
7:12:07
7:38:07
March 9 to 10, 2022

FINAL

Investigation of Indoor Air Quality

Helen Glass Building
89 Curry Place, Winnipeg, Manitoba

Prepared for:

University of Manitoba
120 Physical Plant,
89 Freedman Crescent
Winnipeg, Manitoba, R3T 2N2

April 19, 2022

Pinchin File: 306866

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Issued on: **April 19, 2022**
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EXECUTIVE SUMMARY

Pinchin Ltd. (Pinchin) was retained by University of Manitoba (the Client) to conduct a follow up investigation of indoor air quality (IAQ) that included 24-hour monitoring on March 17, 2022. This follow up investigation was conducted as a result of elevated TVOC measurements recorded during the initial March 9, 2022 assessment. The work was conducted at 89 Curry Place, Winnipeg, Manitoba. Room 470 of the Helen Glass Building was the data logging location chosen by the client as it was occupied by staff and students during the hours of 8:30 am – 10:20 am, 11:00 am – 12:50 pm, and 1:30 pm – 3:20 pm. Room 470 is located on the 4th floor of the Helen Glass Building at the Fort Garry campus. For the follow up investigation the monitoring instrument was placed in a location further distanced from hand sanitizer dispensers in the room. The client also requested that in this location, observations be made specifically to the cleanliness of supply air diffusers and return air grilles. As this is a follow up inspection of the Heating Ventilation Air Conditioning (HVAC) system was not performed.

The majority of the indoor air quality measurements collected were within recommended ranges and meet the criteria of the referenced guidelines. Carbon dioxide concentrations suggested adequate ventilation. Carbon monoxide concentrations did not suggest the presence of exhaust or combustion gases. Temperature measurements were within the recommended comfort ranges for office environments. $PM_{2.5}$, and Total Volatile Organic Compound concentrations were within typical ranges. The Pinchin inspector did not identify any deficiencies with regards to unusual odours during the investigation.

Relative humidity measurements were below the recommended comfort range which may result in dry skin, eye and nose irritation. However, it should be noted that low relative humidity is a common wintertime condition in Canada.

The following recommendations are offered to improve air quality in this building:

1. Communicate the findings of this report to the staff, and health and safety representative; and
2. Review the humidification system in the building to ensure it is operational and functioning properly. Consider making adjustments as necessary.

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1.0 INTRODUCTION AND SCOPE

1.1 Statement of Understanding

Pinchin Ltd. (Pinchin) was retained by University of Manitoba (the Client) to conduct a follow up investigation of indoor air quality (IAQ) that included 24-hour monitoring. This follow up assessment was conducted as a result of elevated TVOC measurements recorded during the initial March 9, 2022 investigation The work was conducted at 89 Curry Place, Winnipeg, Manitoba. Room 470 of the Helen Glass Building was the data logging location chosen by the client as it was occupied by staff and students during the hours of 8:30 am – 10:20 am, 11:00 am – 12:50 pm, and 1:30 pm – 3:20 pm. Room 470 is located on the 4th floor of the Helen Glass Building at the Fort Garry campus. For the follow up investigation, the monitoring instrument was placed in a location further distanced from hand sanitizer dispensers in the room. The client also requested that in this location, observations be made specifically to the cleanliness of supply air diffusers and return air grilles. Re-inspection of the Heating Ventilation Air Conditioning (HVAC) system was not performed during this assessment.

1.2 Scope of Work

Pinchin performed the follow up investigation from March 17 to March 18, 2022. The scope of this investigation was limited to Room 470.

The investigation involved the following activities:

- Review site via in-person walkthrough for factors that could contribute to poor indoor air quality; and
- Data-logging of Carbon Dioxide (CO_2), Carbon Monoxide (CO), Temperature (Temp), Relative Humidity (RH), Total Volatile Organic Compounds (TVOCs) and Particulate Matter smaller than 2.5 micrometres ($PM_{2.5}$) within Room 470.

2.0 METHODOLOGY

2.1 Interviews and Site Reviews

Pinchin interviewed the University of Manitoba Physical Plant, Project and Building Managers to discuss the history of the building, maintenance practices and any indoor air quality concerns.

The investigator did not perform any destructive work to inspect concealed conditions inside wall and/or ceiling cavities.

2.2 Test Methods and Criteria

The following table presents the parameters measured in this investigation, the instruments, the applicable units of measurement, and the Indoor Air Quality criteria used for the evaluation of the results.

Table I – IAQ Parameters Tested, Measurement Criteria and Instruments

Parameter	Unit of Measurement	Recommended Limit	Instrumentation
Carbon dioxide, CO_2	Parts per million in air (ppm)	Outdoor Air (ppm) + 700 ppm [1]	24-hour Data-log Monitoring using a 3M® EVM-7 Air Quality Monitor
Carbon monoxide, CO	ppm	5 ppm [2]	
Temperature, T	°C	21 to 25°C, winter clothing [3]	
Relative Humidity, RH	% RH	25[4] to 65%[5], for occupant comfort	
Total Volatile Organic Compounds, (TVOC)	Parts per billion (ppb)	400 ppb[6]	
Particulate Matter smaller than 2.5 micrometres, $PM_{2.5}$	µg/m³	25 µg/m³ [7]24-hour mean;	

All data-logging direct-reading instruments were calibrated before use.

1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Ventilation for Acceptable Indoor Air Quality* [ANSI/ASHRAE Standard 62.1-2019]. Atlanta, GA: ASHRAE, 2019.
2 Health Canada: *Indoor Air Quality in Office Buildings: A Technical Guide*. Ottawa, ON: Health Canada, 1995.
3 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Thermal Environmental Conditions for Human Occupancy* [ANSI/ASHRAE Standard 55-2020]. Atlanta, GA: ASHRAE, 2020.
4 L.E. Burton, J.G. Girman, S.E. Womble: Airborne particulate matter within 100 randomly selected office buildings in the United States (BASE). Proceedings of Healthy Buildings 2000, Vol. 1 (2001).
5 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Thermal Environmental Conditions for Human Occupancy* [ANSI/ASHRAE Standard 55-2020]. Atlanta, GA:ASHRAE, 2020.
6 Value calculated from: US Environmental Protection Agency (EPA) "Building Assessment Survey and Evaluation (BASE) Study [Online] (Accessed August 25, 2014).
7 W. Team, "WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide : global update 2005 : summary of risk assessment", Apps.who.int, 2021. [Online]. Available: http://apps.who.int/iris/handle/10665/69477 [Accessed: 15-Sep- 2021].

3.0 FINDINGS

3.1 Results of Interviews

Project or Building Manager reported the following:

- Air Handling Units (AHU) filters are changed every three months or as needed;
- The occupant capacity within Room 470 is 40 people; and
- The enrollment/class ranges from 10 to 21 people.

3.2 Facility Description

Table II – Facility Description

Item	Details
Construction Date	1999
Number of Floors	Three floors above grade, one floor below grade
Structural Type	Steel
Foundation Type	Concrete
Exterior Cladding	Brick
HVAC	Forced air
Roof	Built up
Flooring	Vinyl sheet flooring
Interior Walls	Drywall
Ceilings	Acoustic ceiling tile

3.3 Results of Site Reviews

Appendix I presents the drawings.

In the sampling location there were observed to be 8 supply diffusers (Photo #1) and 2 return grates (Photo #2). All supply diffusers and return grates are clean and free from obstructions.

Refer to Table III for photographs from the investigation.

Table III – Photographs from Investigation

Photo 1 - Room 4709 supply diffuser

Photo 2 - Room 470 return grate

3.4 Results of Indoor Air Quality Tests

Appendix II presents the results of data-logging for IAQ parameters.

The EVM 7 air monitor was used for 24-hour data logging within Room 470, of $PM_{2.5}$, CO_2, CO, TVOC, Temperature, and Relative Humidity. The EVM-7 is a direct-reading instrument and was calibrated before use.

3.4.1 Carbon Dioxide (CO_2)

The 24-hour minimum CO_2 concentration recorded within Room 470 was 386 ppm, the maximum CO_2 concentration was 704 ppm. The 24-hour average for CO_2 was 481 ppm. The average CO_2 concentration during **the occupied time** was 627 ppm. On March 17 and March 18 outdoor spot measurements were recorded. The average outdoor CO2 spot measurements for the two days was 428 ppm. The indoor carbon dioxide concentrations were below the limit of 1,128 ppm (428 ppm outdoors plus 700 ppm) recommended by American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) This indicates that the volume of the supply air was adequate for the occupancy loading at the time of the investigation.

3.4.2 Carbon Monoxide (CO)

The 24-hour minimum CO concentration recorded within Room 470 was below the detection limit of the monitoring instrument, the maximum CO concentration was 1 ppm. The 24-hour average for CO was 0.01 ppm. The average CO concentration during **the occupied time** was below the detection limit of the monitoring instrument. On March 17 and March 18 outdoor spot measurements were recorded. The average outdoor CO spot measurements for the two days was below the detection limit of the monitoring instrument. Health Canada advises that the detection of carbon monoxide above 5 ppm indicates a concern requiring further investigation.

3.4.3 Temperature (Temp)

The 24-hour minimum temperature measurement was 20.4 °C, the maximum temperature measurement was 24.6 °C. The 24-hour average temperature measurement was 24.2 °C. The average temperature measurement during **the occupied time** was 24.2 °C. On March 17 and March 18 outdoor spot measurements were taken each day, averaging -3.0 °C for these dates. The indoor temperatures were within the recommended comfort ranges for commercial environments for typical dress during winter conditions, of 21 to 25 °C.

3.4.4 Relative Humidity (RH)

The 24-hour minimum Relative Humidity measurement was 15.5 %RH, the maximum measurement was 26.0 %RH. The 24-hour average measurement for relative humidity was 18.2 %RH. The average relative humidity measurement during **the occupied time** was 20.1 %RH. On March 17 and March 18 outdoor spot measurements were taken each day, averaging 98 %RH for these dates. Relative humidity below 25 %RH may result in complaints of dry skin and eye and nose irritation. Low relative humidity is a common winter time condition in Canada due to difficulties maintaining proper humidification.

3.4.5 Particulate Matter ($PM_{2.5}$)

The 24-hour minimum concentration for $PM_{2.5}$ was below the detection limit of the monitoring instrument, the maximum concentration for $PM_{2.5}$ was 23 µg/m³. The 24-hour average concentration for $PM_{2.5}$ was 4 µg/m³. The average $PM_{2.5}$ concentrations during the occupied time was 5 µg/m³. On March 17 and March 18 outdoor spot measurements were taken each day, averaging 15 µg/m³ for these dates. For reference, World Health Organization (WHO) provides a guideline of 25 µg/m³ over a 24-hour period. The indoor $PM_{2.5}$ concentrations in this building were within the recommended range.

3.4.6 Total Volatile Organic Compounds (TVOC)

The TVOC concentrations were non-detectable or just at the detection limit of the instrumentation for the duration of the 24-hour monitoring. Based on US EPA research, office environments with TVOC concentrations up to 400 ppb would be at little risk of IAQ concern. As this is a guideline, complaints might be expected if concentrations were significantly above 400 ppb.

Table IV – Summary of 24-Hour Data-logging IAQ based on Indoor Air Quality Measurement Criteria

Parameter	Measurement Average	Indoor Air Quality Measurement Criteria	Below Indoor Air Quality Measurement Criteria?
Carbon Dioxide	481 ppm	Outdoor Air (ppm) + 700 ppm	Yes
Carbon Monoxide	0.01 ppm	5 ppm	Yes
Temperature (°C)	24.2 °C	21 to 25 °C, winter clothing	Yes
Relative Humidity (%)	18.2% RH	25 to 65%, for occupant comfort	No
$PM_{2.5}$	4 µg/m³	25 µg/m³	Yes
TVOC	**Below the Detection Limit of the Monitoring Instrument**	400 ppb	Yes

4.0 DISCUSSION

The majority of the indoor air quality measurements collected were within recommended ranges and meet the criteria of the referenced guidelines. Carbon dioxide concentrations suggested adequate ventilation. Carbon monoxide concentrations did not suggest the presence of exhaust or combustion gases. Temperature measurements were within the recommended comfort ranges for office environments. $PM_{2.5}$, and Total Volatile Organic Compound concentrations were within typical ranges. The Pinchin inspector did not identify any deficiencies with regards to unusual odours during the investigation.

Relative humidity measurements were below the recommended comfort range which may result in dry skin, eye and nose irritation. However, it should be noted that low relative humidity is a common wintertime condition in Canada.

During the follow up indoor air quality (IAQ) investigation on March 17, 2022, the 24-hour monitoring instrument was placed away from the hand sanitizing dispenser within room 470. Based on the monitoring results from follow up investigation it is reasonable to conclude that the elevated TVOCs concentrations from the initial IAQ monitoring (March 9, 2022) were caused by the hand sanitizer dispenser.

5.0 RECOMMENDATIONS

The following recommendations are offered to improve air quality in this building:

1. Communicate the findings of this report to the staff, and health and safety representative; and
2. Review the humidification system in the building to ensure it is operational and functioning properly. Consider making adjustments as necessary.

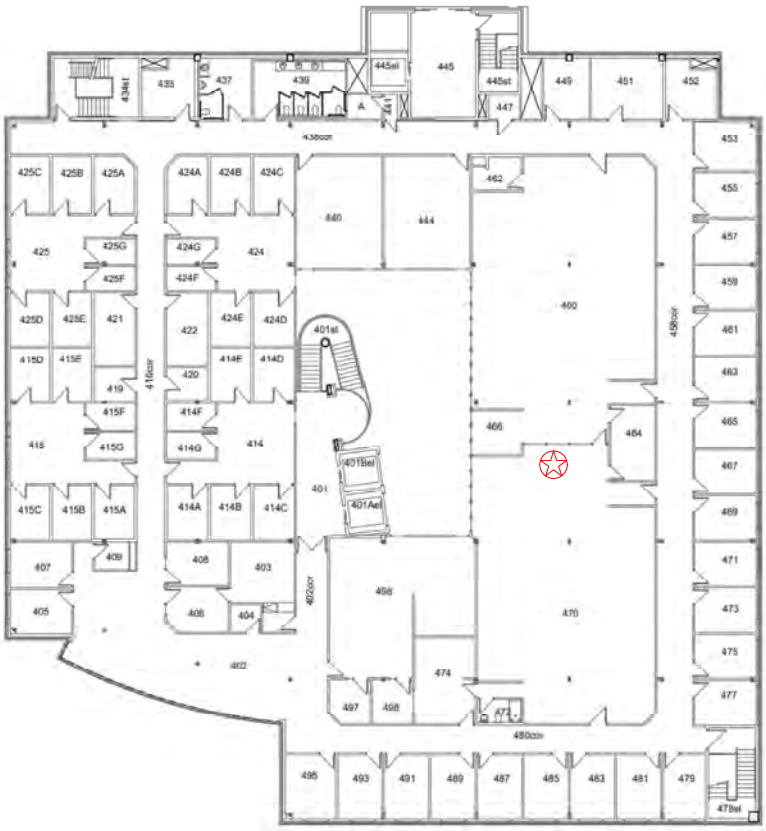
6.0 TERMS AND LIMITATIONS

This work was performed subject to the Terms and Limitations presented or referenced in the proposal for this project.

Information provided by Pinchin is intended for Client use only. Pinchin will not provide results or information to any party unless disclosure by Pinchin is required by law. Any use by a third party of reports or documents authored by Pinchin or any reliance by a third party on or decisions made by a third party based on the findings described in said documents, is the sole responsibility of such third parties. Pinchin accepts no responsibility for damages suffered by any third party as a result of decisions made or actions conducted. No other warranties are implied or expressed.

APPENDIX I

Drawing



N

LEGEND

DATA LOGGING LOCATION

BASE PLAN PROVIDED BY CLIENT.

PINCHIN

PROJECT NAME:
INDOOR AIR QUALITY ASSESSMENT

CLIENT NAME:
UNIVERSITY OF MANITOBA
HELEN GLASS

PROJECT LOCATION:
89 CURRY PLACE
WINNIPEG, MANITOBA

FIGURE NAME:
LEVEL 400

PROJECT NUMBER:	SCALE:
306866	NOT TO SCALE
DRAWN BY:	REVIEWED BY:
CE	JB
DATE:	FIGURE NUMBER:
APRIL 2022	1 OF 1

APPENDIX II

Results of Data-Logging Indoor Air Quality Measurements

Session Report
Helen Glass, Room 470
89 Curry Place

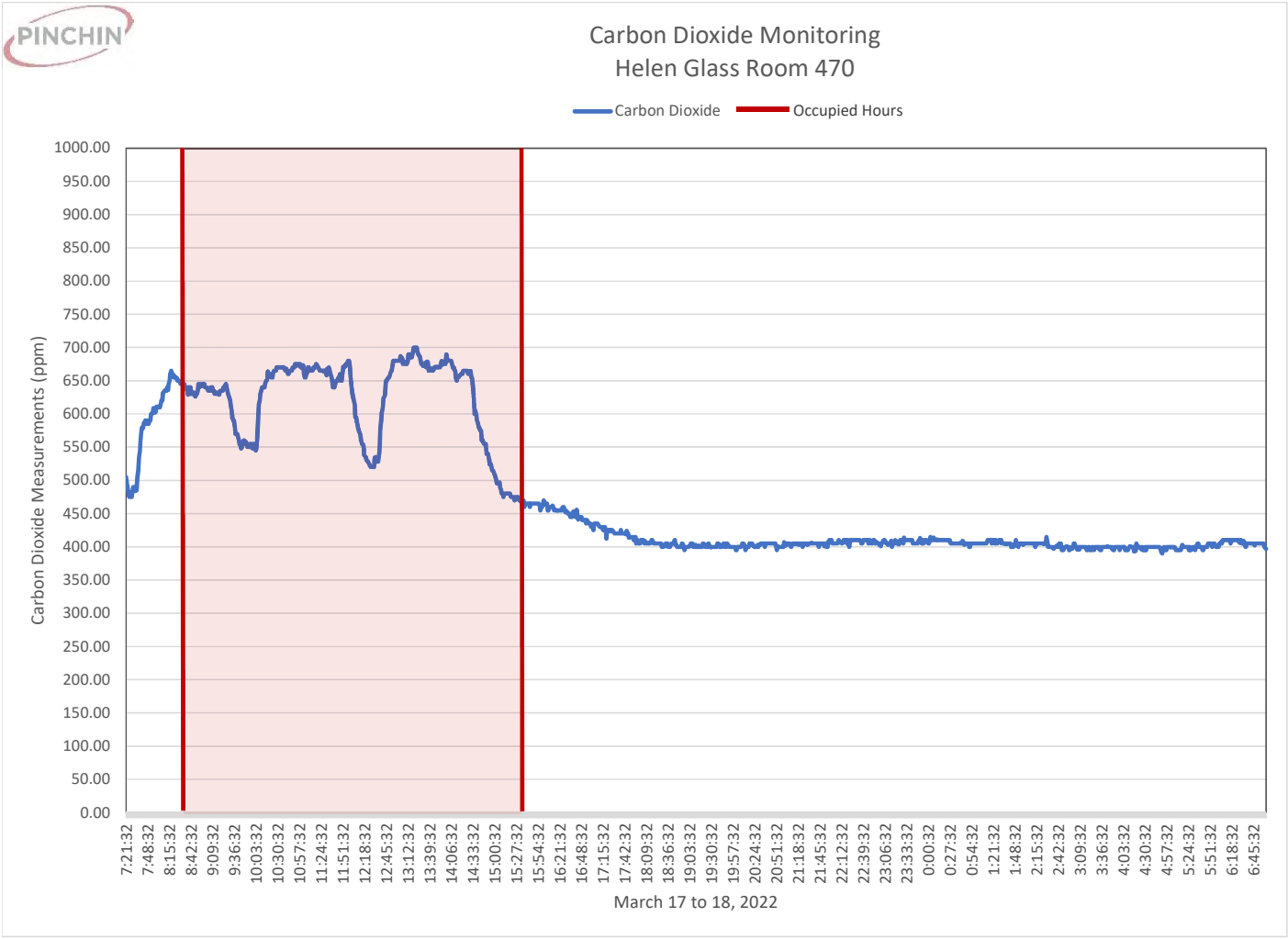
3/17/2022

Datalog Period

Device Name	EMI050016
Serial Number	EMI050016
Run Time	23:38:27
Start Time	3/17/2022 7:20:32 AM
Stop Time	3/18/2022 6:58:59 AM

IAQ Data Summary

Description	Value	Description	Value
CO2Ave	481 PPM	CO2Max	704 PPM
CO2MaxTime	3/17/2022 1:22:34 PM	CO2Min	386 PPM
COAve	0.01 PPM	COMax	1 PPM
COMin	0 PPM	Dust Average	4.000 ug/m³
Dust Max	23.000 ug/m³	Dust Min	0.000 ug/m³
Humidity Avg	18.2 %	Humidity Max	26.0 %
Humidity Max Time	3/17/2022 7:20:46 AM	Humidity Min	15.5 %
Humidity Min Time	3/18/2022 5:07:19 AM	PIDAvePPB	Below the Detection Limit of the Instrument
PIDMaxPPB	Below the Detection Limit of the Instrument	PIDMinPPB	Below the Detection Limit of the Instrument
Temp Avg	24.2 °C	Temp Max Time	3/17/2022 12:50:41 PM
Temp Min Time	3/17/2022 7:20:32 AM	Temperature Max	24.6 °C
Temperature Min	20.4 °C		
Dust Impactor Setting	2.5 µm		


PINCHIN
Carbon Dioxide Monitoring
Helen Glass Room 470
Carbon Dioxide
Occupied Hours
Carbon Dioxide Measurements (ppm)
1000.00
950.00
900.00
850.00
800.00
750.00
700.00
650.00
600.00
550.00
500.00
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
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7:48:32
8:15:32
8:42:32
9:09:32
9:36:32
10:03:32
10:30:32
10:57:32
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13:12:32
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14:06:32
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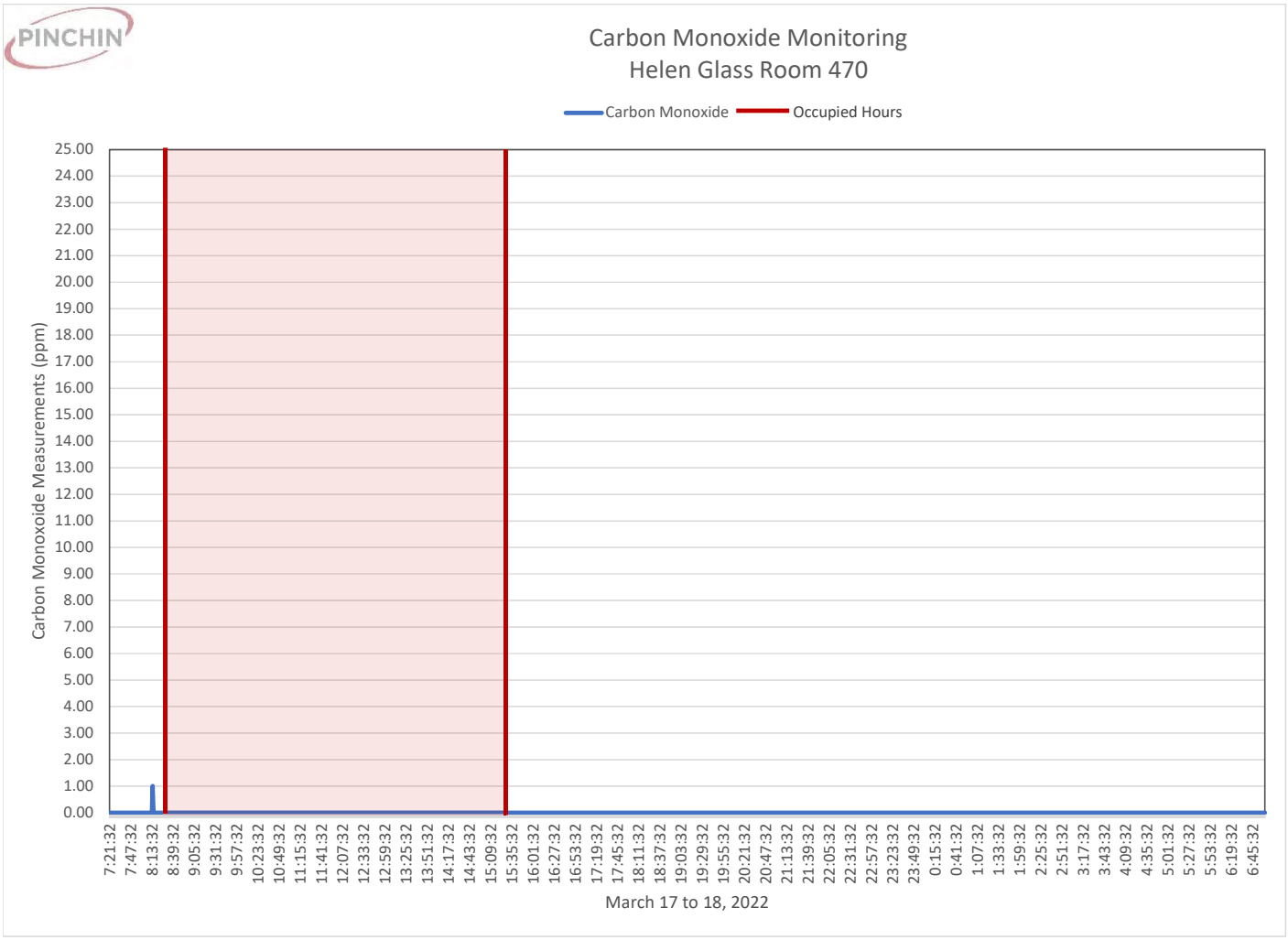
6:45:32
March 17 to 18, 2022


PINCHIN
Carbon Monoxide Monitoring
Helen Glass Room 470
Carbon Monoxide
Occupied Hours
Carbon Monoxide Measurements (ppm)
25.00
24.00
23.00
22.00
21.00
20.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
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3:43:32
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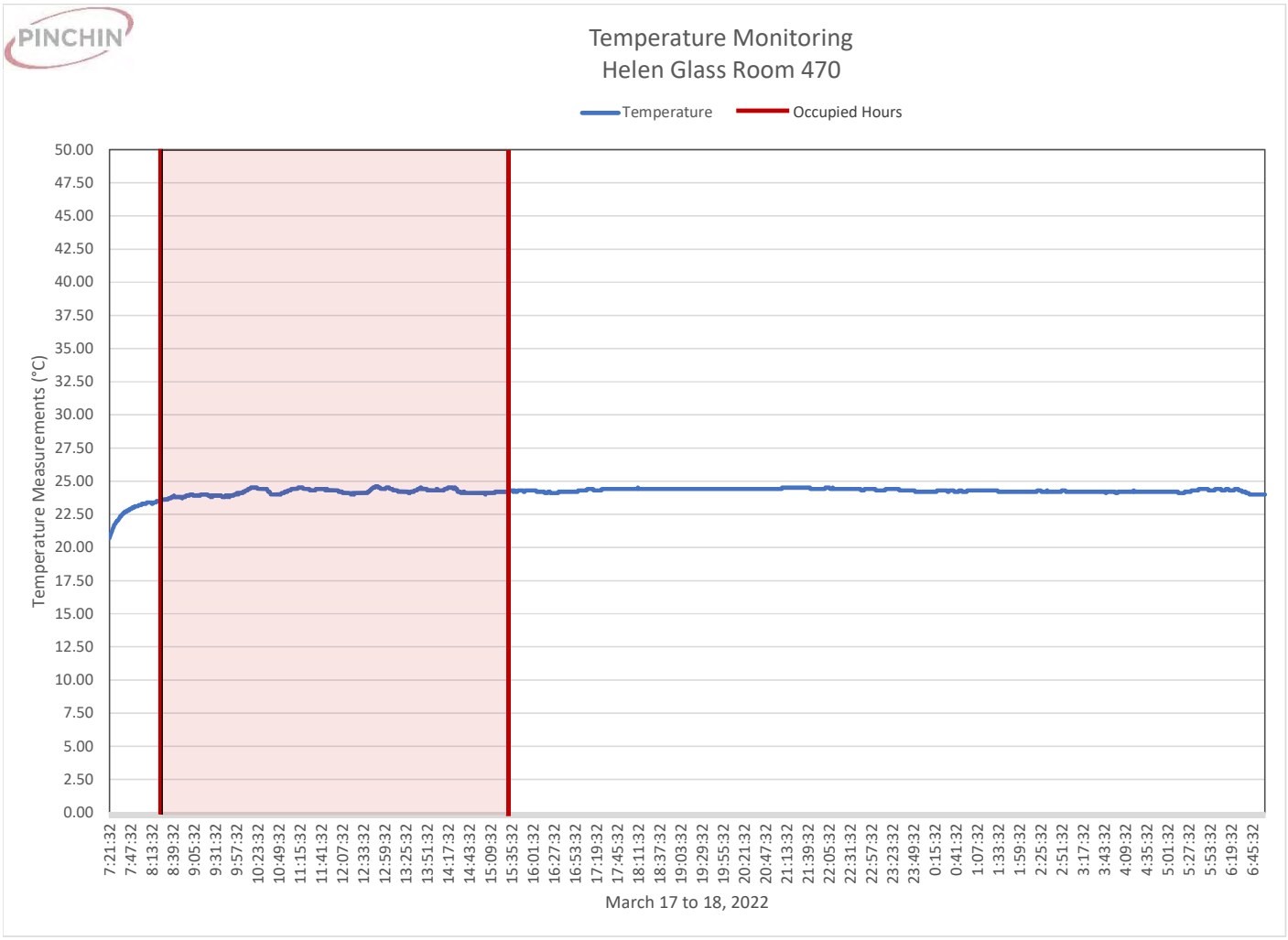
6:45:32
March 17 to 18, 2022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Temperature Monitoring
Helen Glass Room 470
Temperature
Occupied Hours
Temperature Measurements (°C)
50.00
47.50
45.00
42.50
40.00
37.50
35.00
32.50
30.00
27.50
25.00
22.50
20.00
17.50
15.00
12.50
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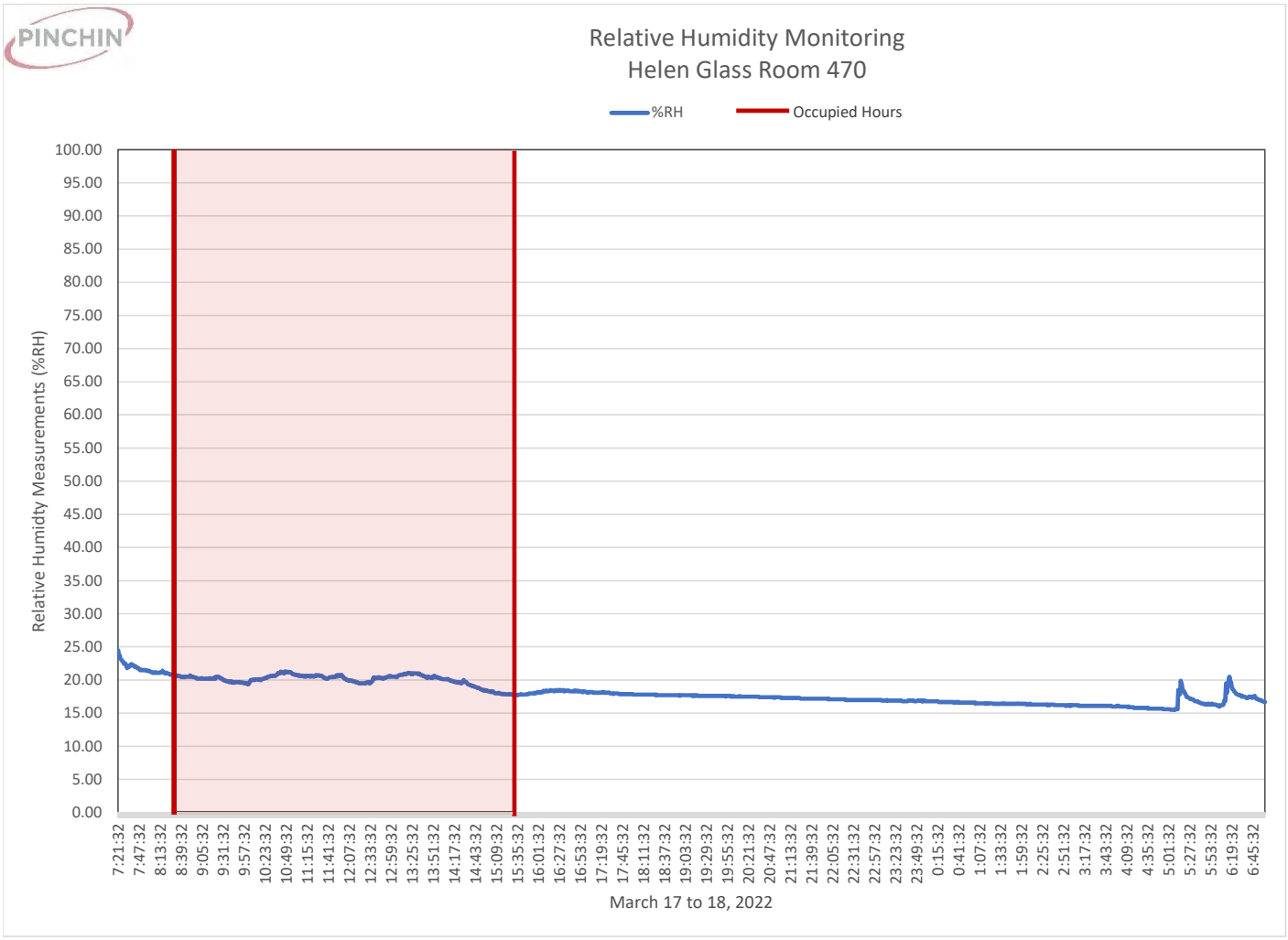
March 17 to 18, 2022


PINCHIN
Relative Humidity Monitoring
Helen Glass Room 470
%RH
Occupied Hours
Relative Humidty Measurements (%RH)
100.00
95.00
90.00
85.00
80.00
75.00
70.00
65.00
60.00
55.00
50.00
45.00
40.00
35.00
30.00
25.00
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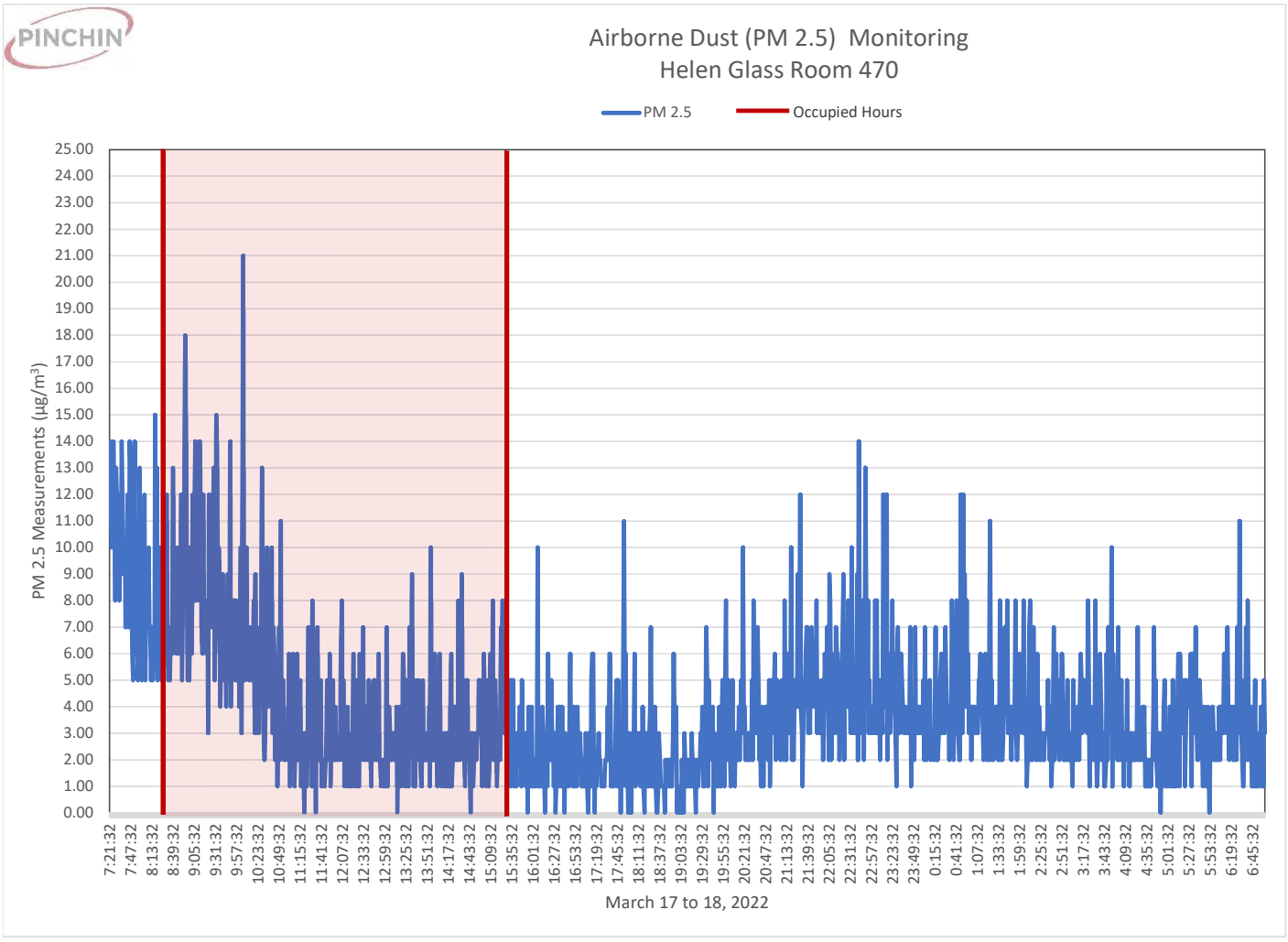
March 17 to 18, 2022


PINCHIN
Airborne Dust (PM 2.5) Monitoring
Helen Glass Room 470
PM 2.5
Occupied Hours
PM 2.5 Measurements (µg/m³)
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24.00
23.00
22.00
21.00
20.00
19.00
18.00
17.00
16.00
15.00
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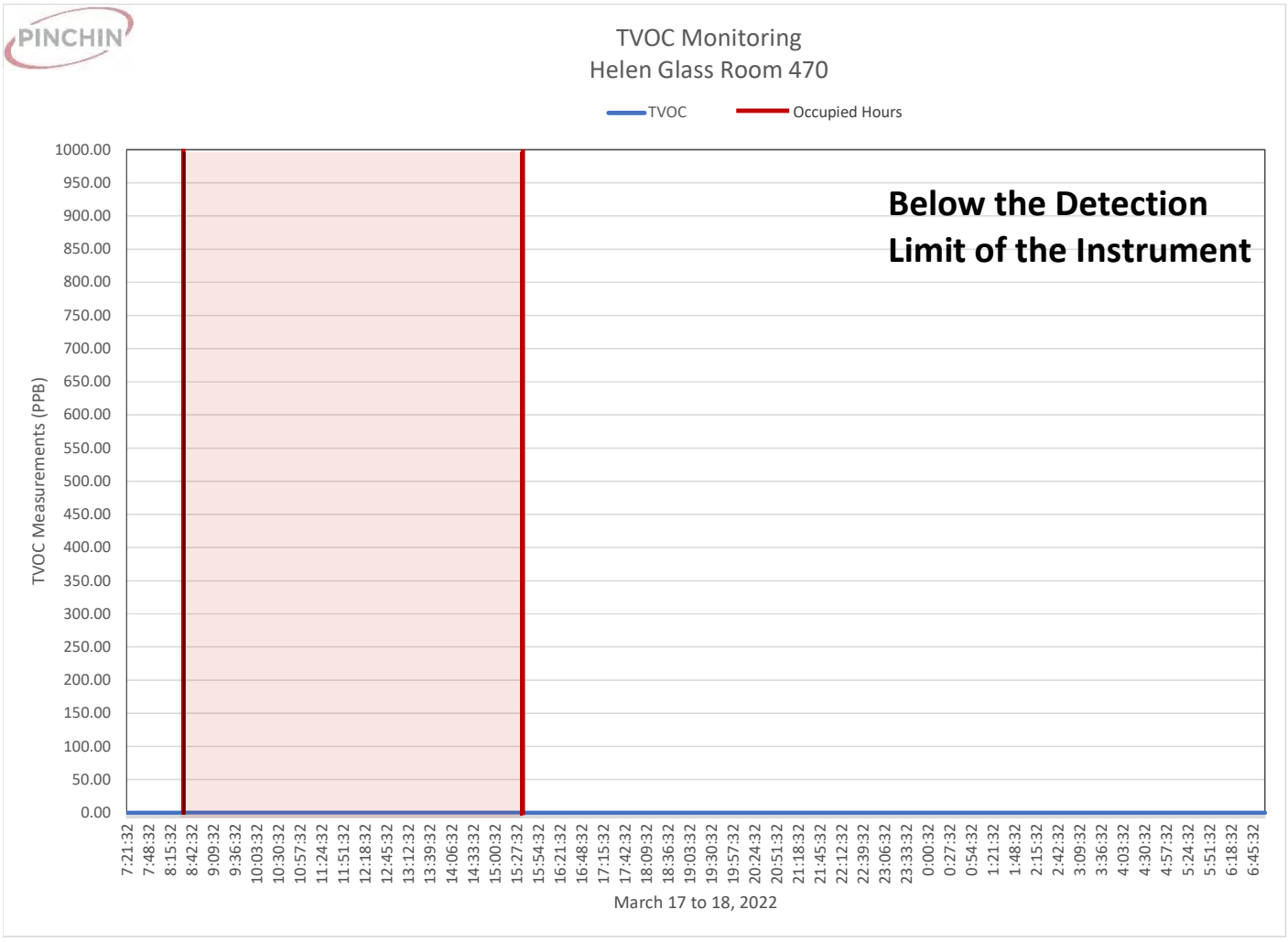
March 17 to 18, 2022


PINCHIN
TVOC Monitoring
Helen Glass Room 470
TVOC
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Below the Detection Limit of the Instrument
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6:45:32
March 17 to 18, 2022

FINAL

Investigation of Indoor Air Quality

Isbister Building
183 Dafoe Road West, Winnipeg, Manitoba

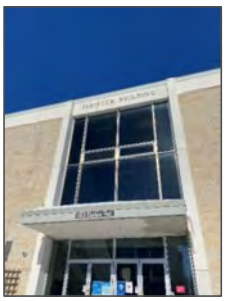
Prepared for:

University of Manitoba
120 Physical Plant,
89 Freedman Crescent
Winnipeg, Manitoba, R3T 2N2

March 25, 2022

Pinchin File: 306866

Issued to: **University of Manitoba**
Issued on: **March 25, 2022**
Pinchin File: **306866**
Issuing Office: **Winnipeg, MB**



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dmuise@pinchin.com

EXECUTIVE SUMMARY

Pinchin Ltd. (Pinchin) was retained by University of Manitoba (the Client) to conduct an investigation of indoor air quality (IAQ) that included 24-hour monitoring. The work was conducted at 183 Dafoe Road West, Winnipeg, Manitoba. Room 136 of the Isbister Building was the data logging location chosen by the client as it was fully occupied by staff and students during the hours of 08:30-11:15, 11:30-14:15, and 14:30-16:50. Room 136 is located on the 100 level of the Isbister Building at the Fort Garry campus. The client also requested that in this location, observations be made specifically to the cleanliness of supply air diffusers and return air grilles. As this is a follow up to the October 6, 2021 assessment, a re-inspection of the Heating Ventilation Air Conditioning (HVAC) system was not performed.

The majority of the indoor air quality measurements collected were within recommended ranges and meet the criteria of the guidelines referenced. Carbon Dioxide concentrations suggested adequate ventilation. Carbon Monoxide concentrations did not suggest the presence of exhaust or combustion gases. Temperature measurements were within the recommended comfort ranges for office environments. $PM_{2.5}$ concentrations were within typical ranges. Total Volatile Organic Compound (TVOC) concentrations were within the recommended range. The Pinchin inspector did not identify any deficiencies with regards to unusual odours during the investigation.

Relative Humidity measurements were below the recommended comfort range which may result in dry skin, eye and nose irritation. However, it should be noted that low relative humidity is a common wintertime condition in Canada.

The following recommendations are offered to improve air quality in this building:

1. Communicate the findings of this report to the staff, and health and safety representitive; and
2. Review the humidification system in the building to ensure it is operational and functioning properly. Consider making adjustments as necessary.

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1.0 INTRODUCTION AND SCOPE

1.1 Statement of Understanding

Pinchin Ltd. (Pinchin) was retained by University of Manitoba (the Client) to conduct an investigation of indoor air quality (IAQ) that included 24-hour monitoring. The work was conducted at 183 Dafoe Road West, Winnipeg, Manitoba. Room 136 of the Isbister Building was the data logging location chosen by the client as it was fully occupied by staff and students throughout the daytime hours. Room 136 is located on the 100 level of the Isbister Building at the Fort Garry campus. The client also requested that in this location, observations be made specifically to the cleanliness of supply air diffusers and return air grilles. As this is a follow up to the October 6, 2021 assessment, a re-inspection of the Heating Ventilation Air Conditioning (HVAC) system was not performed.

1.2 Scope of Work

Pinchin performed the investigation from March 9, 2022 to March 10, 2022. The scope of this investigation was limited to Room 136.

The investigation involved the following activities:

- Walkthrough site reviews for factors that could degrade air quality; and
- Data-logging of Carbon Dioxide (CO_2), Carbon Monoxide (CO), Temperature (Temp), Relative Humidity (RH), Total Volatile Organic Compounds (TVOCs) and Particulate Matter smaller than 2.5 micrometres ($PM_{2.5}$) within Room 136.

2.0 METHODOLOGY

2.1 Interviews and Site Reviews

Pinchin interviewed the University of Manitoba Physical Plant, Project and Building Managers to discuss the history of the building, maintenance practices and any indoor air quality concerns.

The investigator did not perform any destructive work to inspect concealed conditions inside wall and/or ceiling cavities.

2.2 Test Methods and Criteria

The following table presents the parameters measured in this investigation, the instruments and sampling/analytical methods used, the applicable units of measurement, and the Indoor Air Quality criteria used for the evaluation of the results.

Table I – IAQ Parameters Tested, Measurement Criteria and Instruments

Parameter	Unit of Measurement	Recommended Limit	Instrumentation
Carbon dioxide, CO_2	Parts per million in air (ppm)	Outdoor Air (ppm) + 700 ppm [1]	24 hour Data-log Monitoring using a 3M® EVM-7 Air Quality Monitor
Carbon monoxide, CO	ppm	5 ppm [2]	
Temperature, T	°C	21 to 25 °C, winter clothing [3]	
Relative Humidity, RH	% RH	25[4] to 65%[5], for occupant comfort	
Total Volatile Organic Compounds, (TVOC)	Parts per billion (ppb)	400 ppb[6]	
Particulate Matter smaller than 2.5 micrometres, $PM_{2.5}$	µg/m³	25 µg/m³ [7]24-hour mean;	24 hour Data-log Monitoring using an EVM-7 Air Quality Monitor

All data-logging direct-reading instruments were calibrated before use.

1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Ventilation for Acceptable Indoor Air Quality* [ANSI/ASHRAE Standard 62.1-2019]. Atlanta, GA: ASHRAE, 2019.
2 Health Canada: *Indoor Air Quality in Office Buildings: A Technical Guide*. Ottawa, ON: Health Canada, 1995.
3 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Thermal Environmental Conditions for Human Occupancy* [ANSI/ASHRAE Standard 55-2020]. Atlanta, GA: ASHRAE, 2020.
4 L.E. Burton, J.G. Girman, S.E. Womble: Airborne particulate matter within 100 randomly selected office buildings in the United States (BASE). Proceedings of Healthy Buildings 2000, Vol. 1 (2001).
5 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Thermal Environmental Conditions for Human Occupancy* [ANSI/ASHRAE Standard 55-2020]. Atlanta, GA:ASHRAE, 2020.
6 Value calculated from: US Environmental Protection Agency (EPA) "Building Assessment Survey and Evaluation (BASE) Study [Online] Available at http://www.epa.gov/iaq/base/summarized_data.html#Volatile_Organic_Compounds (Accessed August 25, 2014).
7 W. Team, "WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide : global update 2005 : summary of risk assessment", Apps.who.int, 2021. [Online]. Available: http://apps.who.int/iris/handle/10665/69477. [Accessed: 15-Sep- 2021].

3.0 FINDINGS

3.1 Results of Interviews

Project or Building Manager reported the following:

- Air Handling Units (AHU) filters are changed every three months or as needed;
- The occupant capacity within Room 35 people; and
- The enrollment/class ranges from 10 to 32 people.

3.2 Facility Description

Table II – Facility Description

Item	Details
Construction Date	1961
Number of Floors	Three floors above grade, one floor below grade
Structural Type	Steel
Foundation Type	Concrete
Exterior Cladding	Brick, Concrete
HVAC	Forced Air
Roof	Built up
Flooring	Vinyl Floor Tile, Cement, Wood
Interior Walls	Drywall
Ceilings	Acoustic Ceiling Tile

3.3 Results of Site Reviews

Appendix I presents the drawings.

During the investigation Pinchin noted the supply diffusers were clear from any obstructions, and were observed clean (Photo #1)

Refer to Table III for photographs from the investigation.

Table III – Photographs from Investigation

Photo 1 - Supply air diffuser.

3.4 Results of Indoor Air Quality Tests

Appendix II presents the results of data-logging for IAQ parameters.

The EVM 7 air monitor was used for 24-hour data logging, within Room 136 of $PM_{2.5}$, CO_2, CO, TVOC, Temperature, and Relative Humidity. The EVM-7 is a direct-reading and datalogging instrument and were calibrated before use.

3.4.1 Carbon Dioxide (CO_2)

The 24-hour minimum CO_2 concentration recorded within the building was 370 ppm, the maximum CO_2 concentration was 544 ppm. The 24-hour average for CO_2 was 409 ppm. The average CO_2 concentration during **the occupied time** was 448 ppm. On March 9 and March 10 outdoor spot measurements were recorded. The average outdoor CO2 spot measurements for the two days was 423 ppm. The indoor carbon dioxide concentrations were below the limit of 1123 ppm (423 ppm outdoors plus 700 ppm) recommended by American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) to provide indoor air quality acceptable to the majority of occupants. This indicates that the supply of outdoor air was adequate for the occupancy loading at the time of the investigation.

3.4.2 Carbon Monoxide (CO)

The carbon monoxide concentrations were non-detectable or just at the detection limit of the instrumentation for the duration of the 24-hour monitoring. Health Canada advises that the detection of Carbon Monoxide above 5 ppm indicates a concern requiring further investigation.

3.4.3 Temperature (Temp)

The 24-hour minimum Temperature measurement was 19.7 °C, the maximum temperature measurement was 22.9 °C. The 24-hour average temperature measurement was 22.4 °C. The average temperature measurements during **the occupied time** was 22.6 °C. On March 9 and March 10 outdoor spot measurements were taken each day. The average outdoor Temperature spot measurements for the two days was -19.5 °C . The indoor Temperatures were within the recommended comfort ranges for office environments for typical dress during winter conditions, of 21 to 25 °C .

3.4.4 Relative Humidity (RH)

The 24-hour minimum Relative Humidity measurement was 1.5 %RH, the maximum relative humidity measurement was 6.1 %RH. The 24-hour average measurement for relative humidity averaged 2.7 %RH. The average relative humidity measurement during **the occupied time** was 3.53 %RH. On March 9 and March 10 outdoor spot measurements were taken each day. The average outdoor Relative Humidity spot measurements for the two days was 64 %RH. Relative humidity below 25 %RH may result in complaints of dry skin and eye and nose irritation. Low relative humidity is a common winter time condition in Canada due to difficulties with humidification.

3.4.5 Particulate Matter ($PM_{2.5}$)

The 24-hour minimum concentration for $PM_{2.5}$ was below the detection limit of the monitoring instrument, the maximum concentration for $PM_{2.5}$ was 16 µg/m³. The 24-hour average concentration for $PM_{2.5}$ averaged 0.30 µg/m³. The average $PM_{2.5}$ concentrations during **the occupied time** was 0.38 µg/m³. On March 9 and March 10 outdoor spot measurements were taken each day. The average outdoor $PM_{2.5}$ spot measurements for the two days was 26 µg/m³. For reference, World Health Organization (WHO) provides a guideline of 25 µg/m³ over a 24-hour period. The indoor $PM_{2.5}$ concentrations in this building were within the recommended range.

3.4.6 Total Volatile Organic Compounds (TVOC)

The TVOC concentrations were non-detectable or just at the detection limit of the instrumentation for the duration of the 24-hour monitoring. Based on US EPA research, office environments with TVOC concentrations up to 400 ppb would be at little risk of IAQ concern. As this is a guideline, complaints might be expected if concentrations were significantly above 400 ppb.

Table IV – Summary of 24-Hour Data-logging IAQ based on Indoor Air Quality Criteria

Parameter	**Measurement Average**	**Indoor Air Quality Measurement Criteria**	**Below Indoor Air Quality Measurement Criteria?**
Carbon Dioxide	409 ppm	Outdoor Air (ppm) + 700 ppm	Yes
Carbon Monoxide	0 ppm	5ppm	Yes
Temperature (°C)	22.4 °C	21 to 25 °C, winter clothing	Yes
Relative Humidity (%)	3.53% RH	25 to 65 %, for occupant comfort	No
$PM_{2.5}$	0.30 µg/m³	25 µg/m³	Yes
TVOC	**Below the Detection Limit of the Monitoring Instrument**	400 ppb	Yes

4.0 DISCUSSION

The majority of the indoor air quality measurements collected were within recommended ranges and meet the criteria of the guidelines referenced. Carbon Dioxide concentrations suggested adequate ventilation. Carbon Monoxide concentrations did not suggest the presence of exhaust or combustion gases. Temperature measurements were within the recommended comfort ranges for office environments. $PM_{2.5}$ concentrations were within typical ranges. Total Volatile Organic Compound (TVOC) concentrations were within the recommended range The Pinchin inspector did not identify any deficiencies with regards to unusual odours during the investigation.

Relative Humidity measurements were below the recommended comfort range which may result in dry skin, eye and nose irritation. However, it should be noted that low relative humidity is a common wintertime condition in Canada.

5.0 RECOMMENDATIONS

Pinchin offers the following recommendations to improve air quality in this building.

1. Communicate the findings of this report to the staff, and health and safety representitive; and
2. Review the humidification system in the building to ensure it is operational and functioning properly. Consider making adjustments as necessary.

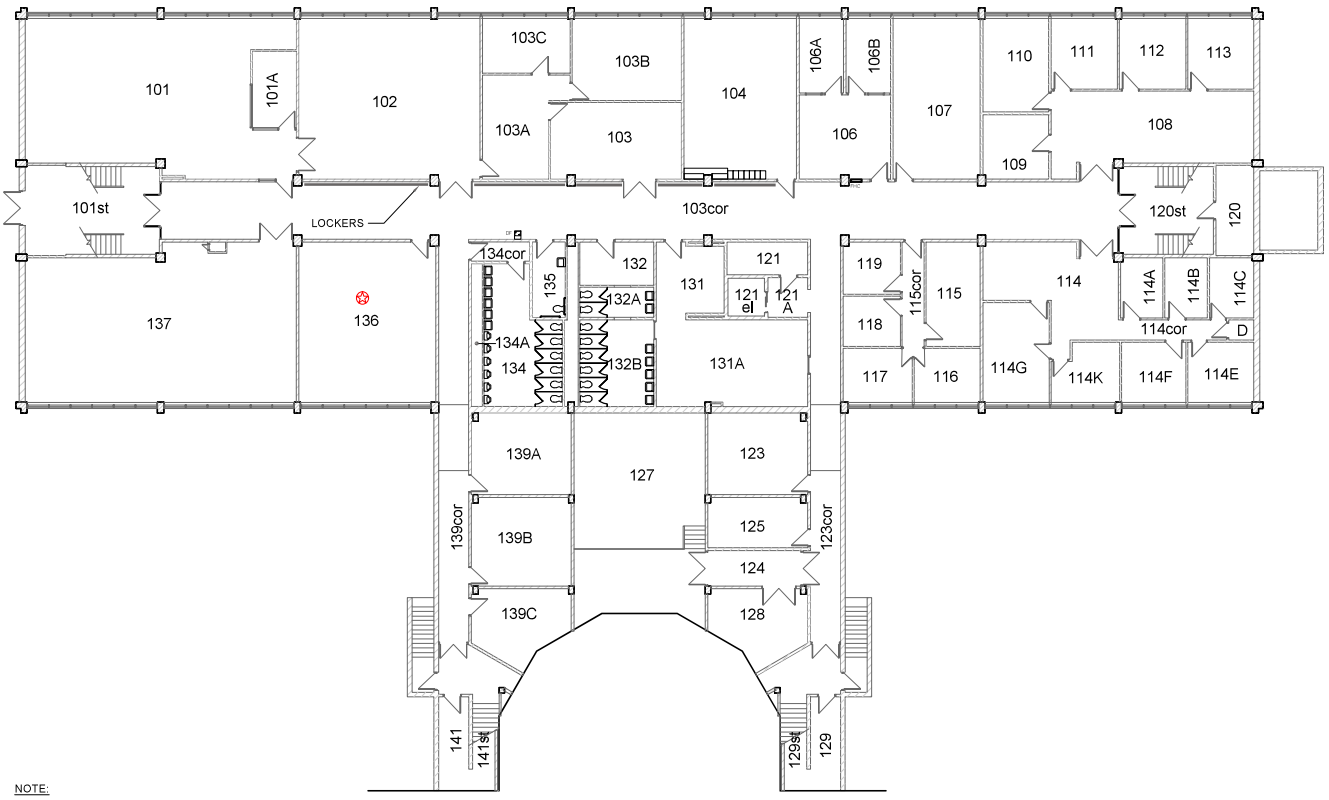
6.0 TERMS AND LIMITATIONS

This work was performed subject to the Terms and Limitations presented or referenced in the proposal for this project.

Information provided by Pinchin is intended for Client use only. Pinchin will not provide results or information to any party unless disclosure by Pinchin is required by law. Any use by a third party of reports or documents authored by Pinchin or any reliance by a third party on or decisions made by a third party based on the findings described in said documents, is the sole responsibility of such third parties. Pinchin accepts no responsibility for damages suffered by any third party as a result of decisions made or actions conducted. No other warranties are implied or expressed.

APPENDIX I

Drawing(s)



NOTE:

LEGEND IS COLOUR DEPENDENT. NON-COLOUR COPIES MAY ALTER INTERPRETATION.

N

LEGEND

DATA LOGGING LOCATION

PINCHIN

PROJECT NAME:	Indoor Air Quality Assessment
CLIENT NAME:	University Of Manitoba
PROJECT LOCATION:	100 Level
FIGURE NAME:	Isbister Building 183 Dafoe Road West Winnipeg, Manitoba
PROJECT NUMBER: 306866.000	SCALE: NTS
DRAWN BY: BJA	REVIEWED BY: JB
DATE: March 2022	FIGURE NUMBER: 1 OF 1

APPENDIX II

Results of Data-Logging Indoor Air Quality Measurements

Session Report
183 Dafoe Road
Isbister Road

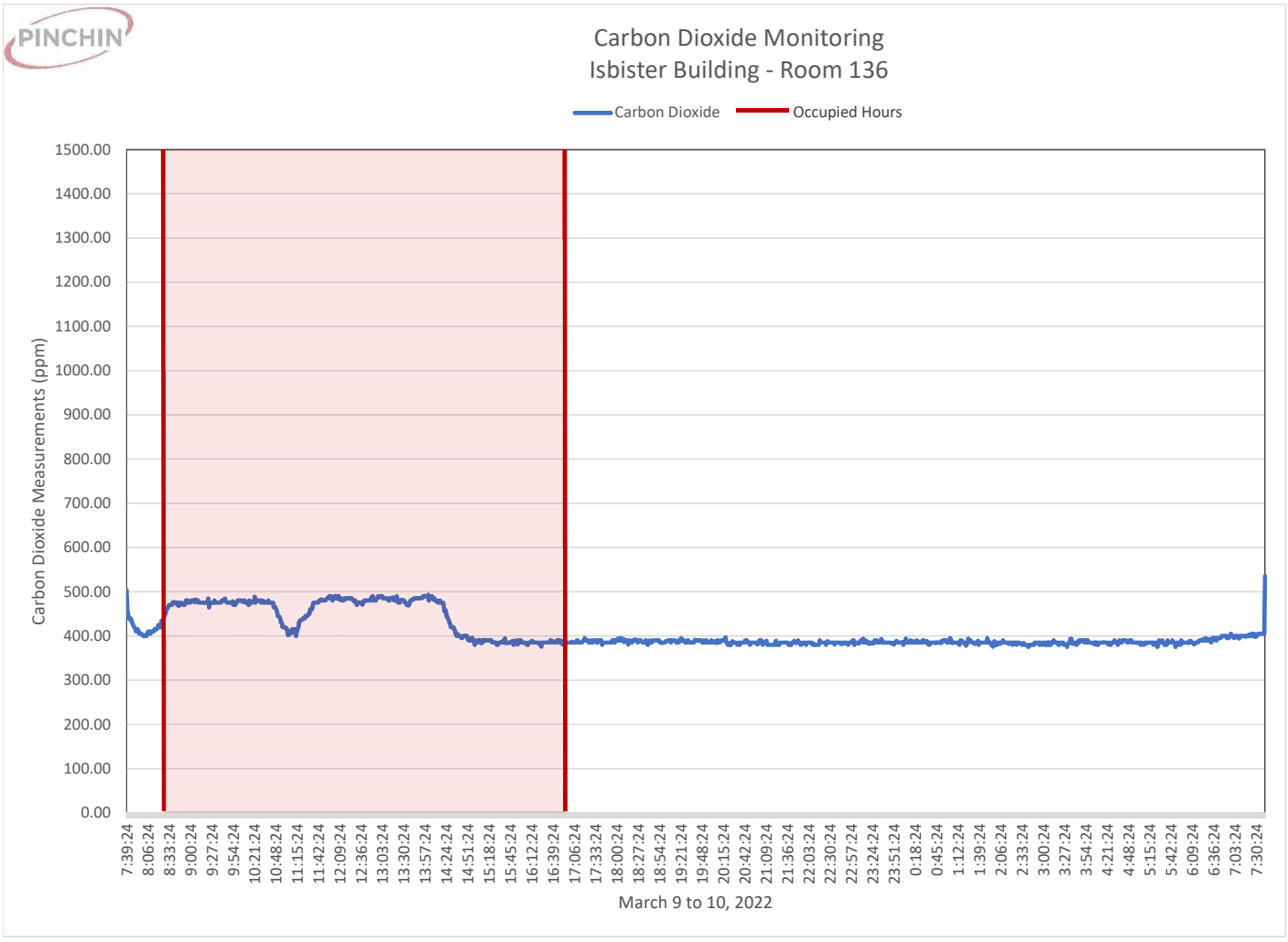
3/9/2022

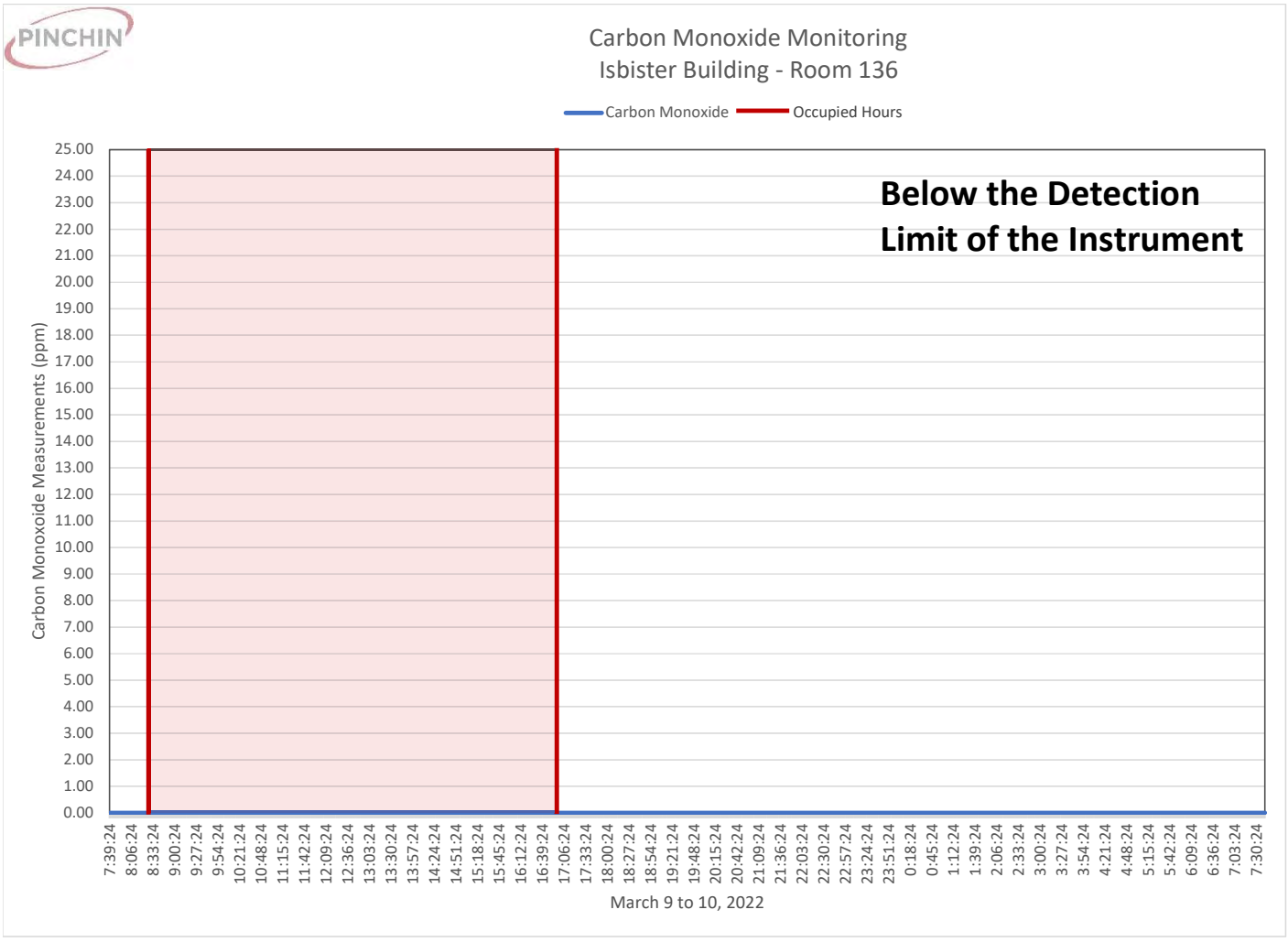
Datalog Period

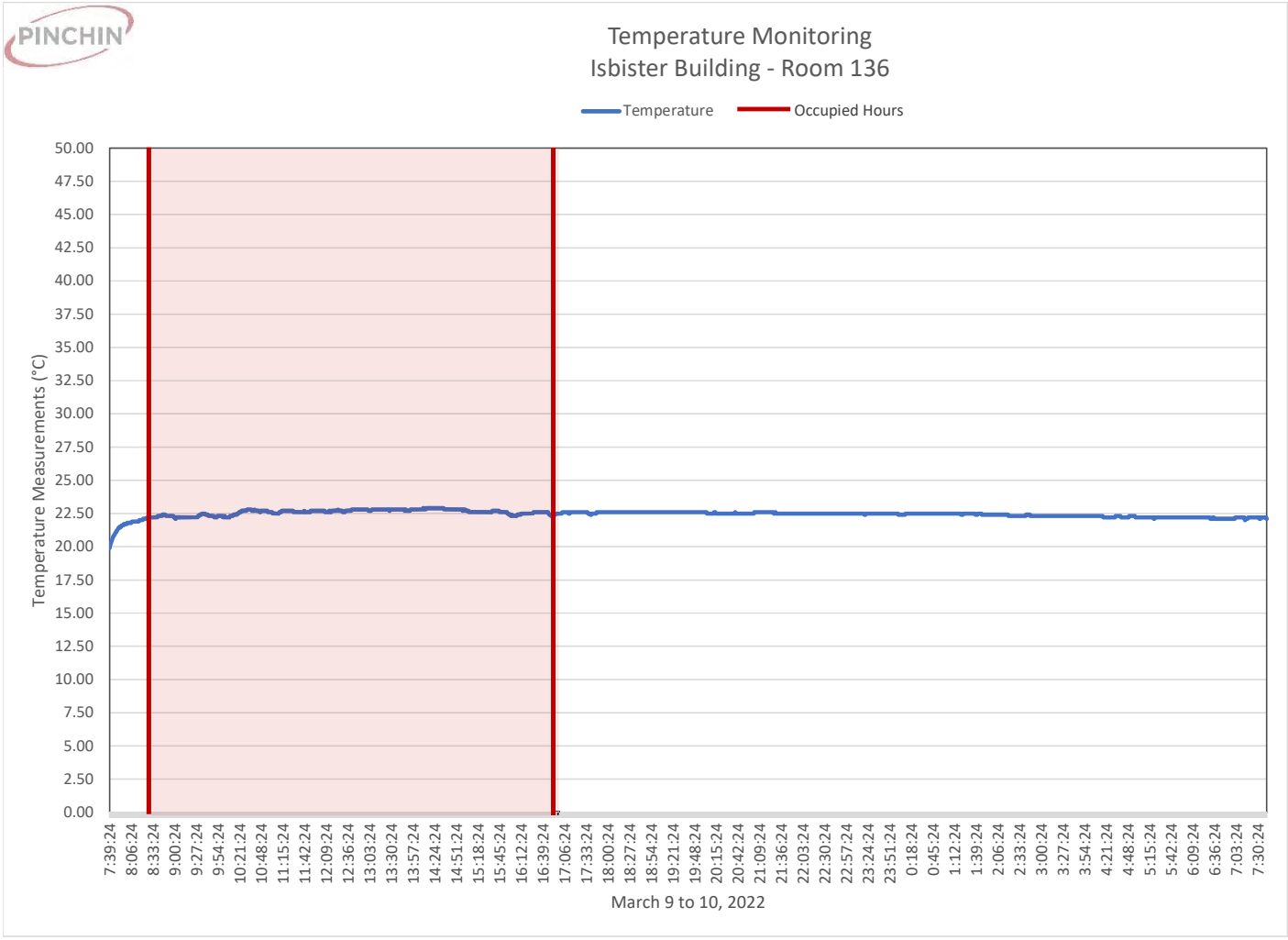
Device Name	EMM120003
Serial Number	EMM120003
Run Time	1.00:00:23
Start Time	3/9/2022 7:38:24 AM
Stop Time	3/10/2022 7:38:47 AM

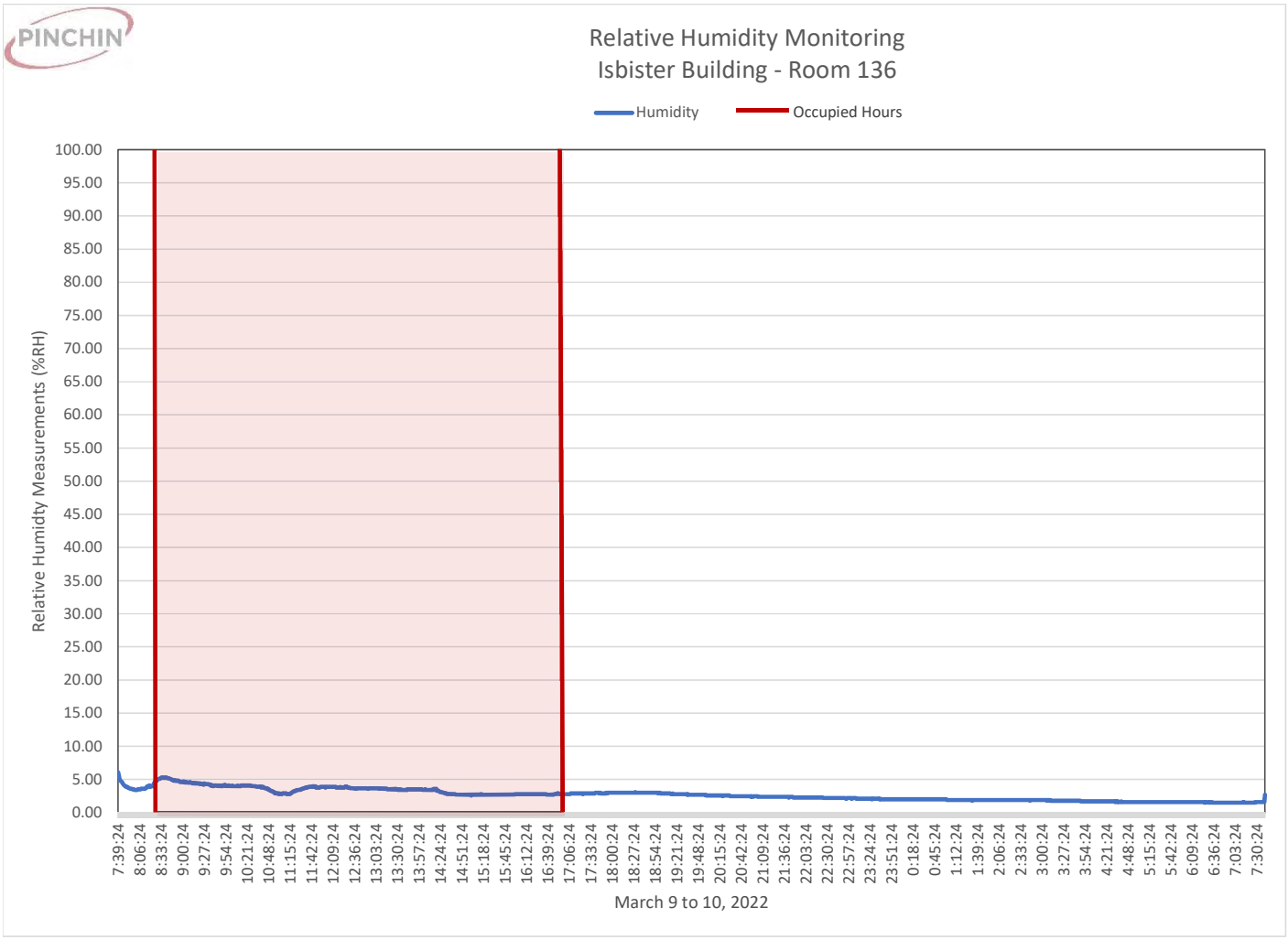
IAQ Data Summary

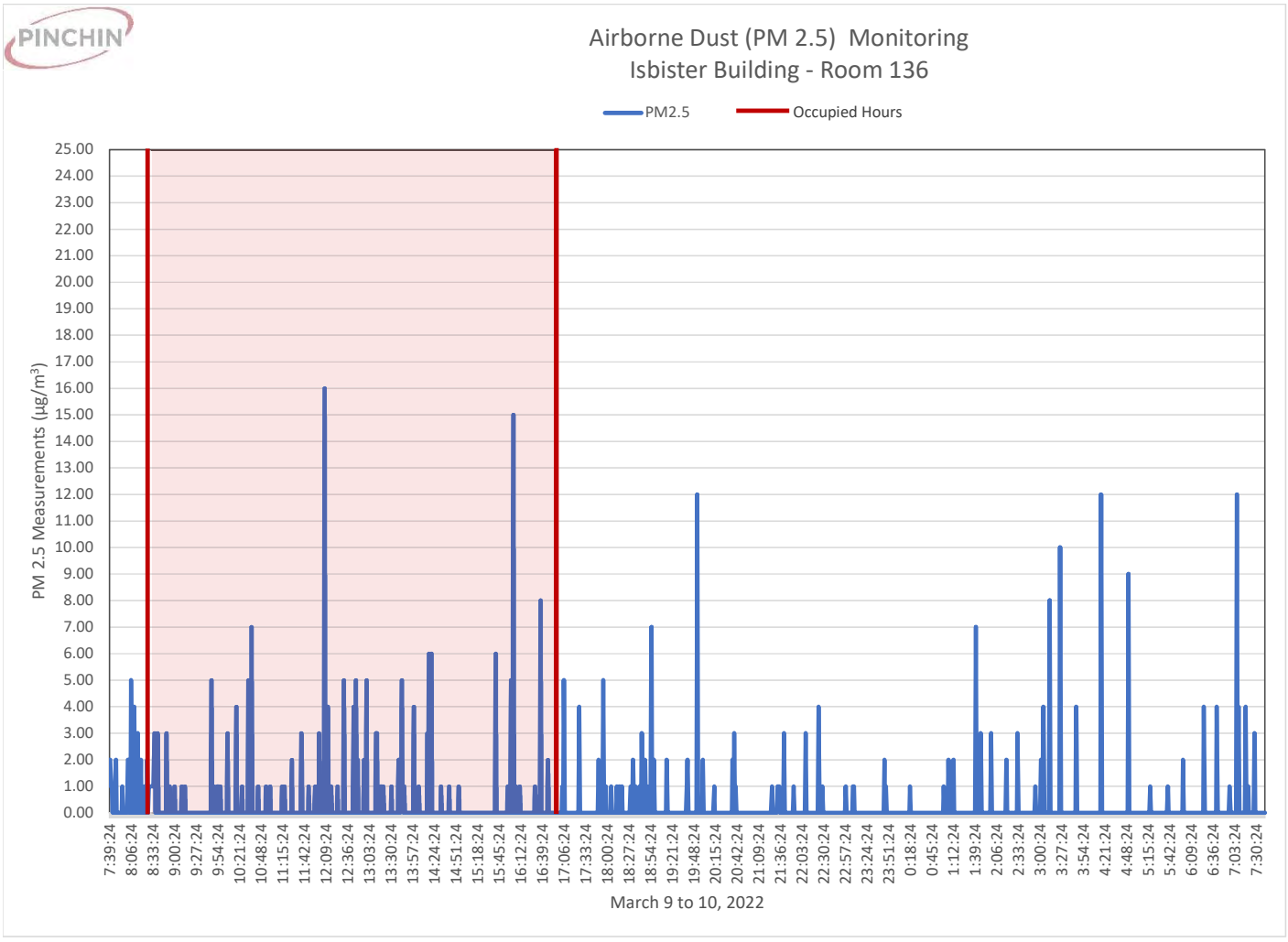
Description	Value	Description	Value
CO2Ave	409 PPM	CO2Max	544 PPM
CO2MaxTime	3/10/2022 7:40:35 AM	CO2Min	370 PPM
COAve	0 PPM	COMax	0 PPM
COMin	0 PPM	Dust Average	0.300 ug/m³
Dust Max	25.000 ug/m³	Dust Min	0.000 ug/m³
Humidity Avg	2.7 %	Humidity Max	6.1 %
Humidity Max Time	3/9/2022 7:39:18 AM	Humidity Min	1.5 %
Humidity Min Time	3/10/2022 7:11:33 AM	PIDAvePPB	Below the Detection Limit of the Monitoring Equipment
PIDMaxPPB	Below the Detection Limit of the Monitoring Equipment	PIDMinPPB	Below the Detection Limit of the Monitoring Equipment
Temp Avg	22.4 °C	Temp Max Time	3/9/2022 2:20:35 PM
Temp Min Time	3/9/2022 7:38:24 AM	Temperature Max	22.9 °C
Temperature Min	19.7 °C		
Dust Impactor Setting	2.5 µm		


PINCHIN
Carbon Dioxide Monitoring
Isbister Building - Room 136
Carbon Dioxide
Occupied Hours
Carbon Dioxide Measurements (ppm)
1500.00
1400.00
1300.00
1200.00
1100.00
1000.00
900.00
800.00
700.00
600.00
500.00
400.00
300.00
200.00
100.00
0.00
7:39:24
8:06:24
8:33:24
9:00:24
9:27:24
9:54:24
10:21:24
10:48:24
11:15:24
11:42:24
12:09:24
12:36:24
13:03:24
13:30:24
13:57:24
14:24:24
14:51:24
15:18:24
15:45:24
16:12:24
16:39:24
17:06:24
17:33:24
18:00:24
18:27:24
18:54:24
19:21:24
19:48:24
20:15:24
20:42:24
21:09:24
21:36:24
22:03:24
22:30:24
22:57:24
23:24:24
23:51:24
0:18:24
0:45:24
1:12:24
1:39:24
2:06:24
2:33:24
3:00:24
3:27:24
3:54:24
4:21:24
4:48:24
5:15:24
5:42:24
6:09:24
6:36:24
7:03:24
7:30:24
March 9 to 10, 2022


PINCHIN
Carbon Monoxide Monitoring
Isbister Building - Room 136
Carbon Monoxide
Occupied Hours
Below the Detection Limit of the Instrument
Carbon Monoxide Measurements (ppm)
25.00
24.00
23.00
22.00
21.00
20.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
7:39:24
8:06:24
8:33:24
9:00:24
9:27:24
9:54:24
10:21:24
10:48:24
11:15:24
11:42:24
12:09:24
12:36:24
13:03:24
13:30:24
13:57:24
14:24:24
14:51:24
15:18:24
15:45:24
16:12:24
16:39:24
17:06:24
17:33:24
18:00:24
18:27:24
18:54:24
19:21:24
19:48:24
20:15:24
20:42:24
21:09:24
21:36:24
22:03:24
22:30:24
22:57:24
23:24:24
23:51:24
0:18:24
0:45:24
1:12:24
1:39:24
2:06:24
2:33:24
3:00:24
3:27:24
3:54:24
4:21:24
4:48:24
5:15:24
5:42:24
6:09:24
6:36:24
7:03:24
7:30:24
March 9 to 10, 2022


PINCHIN
Temperature Monitoring
Isbister Building - Room 136
Temperature
Occupied Hours
Temperature Measurements (°C)
50.00
47.50
45.00
42.50
40.00
37.50
35.00
32.50
30.00
27.50
25.00
22.50
20.00
17.50
15.00
12.50
10.00
7.50
5.00
2.50
0.00
7:39:24
8:06:24
8:33:24
9:00:24
9:27:24
9:54:24
10:21:24
10:48:24
11:15:24
11:42:24
12:09:24
12:36:24
13:03:24
13:30:24
13:57:24
14:24:24
14:51:24
15:18:24
15:45:24
16:12:24
16:39:24
17:06:24
17:33:24
18:00:24
18:27:24
18:54:24
19:21:24
19:48:24
20:15:24
20:42:24
21:09:24
21:36:24
22:03:24
22:30:24
22:57:24
23:24:24
23:51:24
0:18:24
0:45:24
1:12:24
1:39:24
2:06:24
2:33:24
3:00:24
3:27:24
3:54:24
4:21:24
4:48:24
5:15:24
5:42:24
6:09:24
6:36:24
7:03:24
7:30:24
March 9 to 10, 2022


PINCHIN
Relative Humidity Monitoring
Isbister Building - Room 136
Humidity
Occupied Hours
Relative Humidty Measurements (%RH)
100.00
95.00
90.00
85.00
80.00
75.00
70.00
65.00
60.00
55.00
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
7:39:24
8:06:24
8:33:24
9:00:24
9:27:24
9:54:24
10:21:24
10:48:24
11:15:24
11:42:24
12:09:24
12:36:24
13:03:24
13:30:24
13:57:24
14:24:24
14:51:24
15:18:24
15:45:24
16:12:24
16:39:24
17:06:24
17:33:24
18:00:24
18:27:24
18:54:24
19:21:24
19:48:24
20:15:24
20:42:24
21:09:24
21:36:24
22:03:24
22:30:24
22:57:24
23:24:24
23:51:24
0:18:24
0:45:24
1:12:24
1:39:24
2:06:24
2:33:24
3:00:24
3:27:24
3:54:24
4:21:24
4:48:24
5:15:24
5:42:24
6:09:24
6:36:24
7:03:24
7:30:24
March 9 to 10, 2022


PINCHIN
Airborne Dust (PM 2.5) Monitoring
Isbister Building - Room 136
PM2.5
Occupied Hours
PM 2.5 Measurements (µg/m³)
25.00
24.00
23.00
22.00
21.00
20.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
7:39:24
8:06:24
8:33:24
9:00:24
9:27:24
9:54:24
10:21:24
10:48:24
11:15:24
11:42:24
12:09:24
12:36:24
13:03:24
13:30:24
13:57:24
14:24:24
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20:15:24
20:42:24
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22:57:24
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23:51:24
0:18:24
0:45:24
1:12:24
1:39:24
2:06:24
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3:00:24
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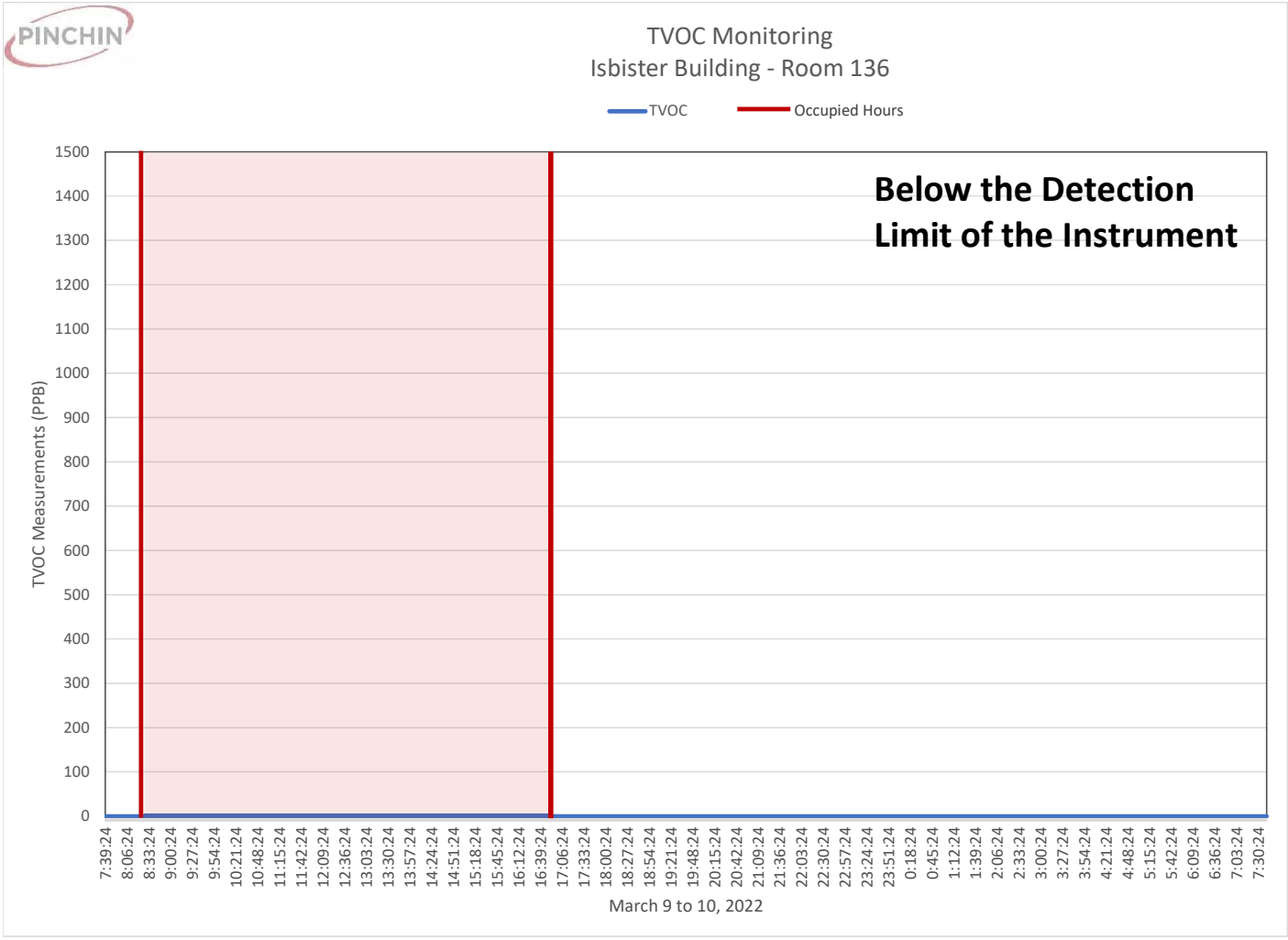
3:54:24
4:21:24
4:48:24
5:15:24
5:42:24
6:09:24
6:36:24
7:03:24
7:30:24
March 9 to 10, 2022


PINCHIN
TVOC Monitoring
Isbister Building - Room 136
TVOC
Occupied Hours
Below the Detection Limit of the Instrument
TVOC Measurements (PPB)
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
7:39:24
8:06:24
8:33:24
9:00:24
9:27:24
9:54:24
10:21:24
10:48:24
11:15:24
11:42:24
12:09:24
12:36:24
13:03:24
13:30:24
13:57:24
14:24:24
14:51:24
15:18:24
15:45:24
16:12:24
16:39:24
17:06:24
17:33:24
18:00:24
18:27:24
18:54:24
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19:48:24
20:15:24
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0:18:24
0:45:24
1:12:24
1:39:24
2:06:24
2:33:24
3:00:24
3:27:24
3:54:24
4:21:24
4:48:24
5:15:24
5:42:24
6:09:24
6:36:24
7:03:24
7:30:24
March 9 to 10, 2022

FINAL

Investigation of Indoor Air Quality

Parker Building
144 Dysart Road, Winnipeg, Manitoba

Prepared for:

University of Manitoba
120 Physical Plant,
89 Freedman Crescent
Winnipeg, Manitoba R3T 2N2

March 31, 2022

Pinchin File: 306866

Issued to:	**University of Manitoba**
Issued on:	**March 31, 2022**
Pinchin File:	**306866**
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EXECUTIVE SUMMARY

Pinchin Ltd. (Pinchin) was retained by University of Manitoba (the Client) to conduct an investigation of indoor air quality (IAQ) that included 24-hour monitoring. The work was conducted at 144 Dysart Road, Winnipeg, Manitoba. Room 406 of the Parker Building was the data logging location chosen by the client as it was occupied by staff and students during the hours of 14:30 – 17:30. Room 406 is located on the 4th floor of the Parker building at the Fort Garry campus. The client also requested that in this location, observations be made specifically to the cleanliness of supply air diffusers and return air grilles.

Along with the 24 hour monitoring in Room 406 the client requested an inspection of the Heating Ventilation Air Conditioning (HVAC) system to determine if there were conditions present that could degrade air quality, i.e., dirty or wrongly fitted filters, presence of moisture, etc..

The majority of the indoor air quality measurements collected were within recommended ranges and meet the criteria of the referenced guidelines. Carbon dioxide concentrations suggested adequate ventilation. Carbon monoxide concentrations did not suggest the presence of exhaust or combustion gases. Temperature measurements are within the recommended comfort ranges for office environments. $PM_{2.5}$ concentrations are within typical ranges. Total Volatile Organic Compound (TVOC) concentrations were within the recommended range. As well the Pinchin inspector did not identify any deficiencies with regards to unusual odours during the investigation.

Relative humidity measurements were below the recommended comfort range which may result in dry skin, eye and nose irritation. However, it should be noted that low relative humidity is a common wintertime condition in Canada.

Pinchin inspected the Air Handling Units (AHUs) and concluded that they are in proper working order with no leaks or standing water build up. The filters in AHU M74 and M75 were clean and free of visible dust and debris.

The following recommendations are offered to improve air quality in this building:

1. Communicate the findings of this report to the staff, and health and safety representative; and
2. Review the humidification system in the building to ensure it is operational and functioning properly. Consider making adjustments as necessary.

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1.0 INTRODUCTION AND SCOPE

1.1 Statement of Understanding

Pinchin Ltd. (Pinchin) was retained by University of Manitoba (the Client) to conduct an investigation of Indoor Air Quality (IAQ) that included 24-hour monitoring. The work was conducted at 144 Dysart Road, Winnipeg, Manitoba. Room 406 of the Parker Building was the date logging location chosen by the client as it was fully occupied by staff and students throughout the daytime hours. Room 406 is located on the 4th floor of the Parker Building at the Fort Garry campus. The client also requested that at this location, observations be made specifically to the cleanliness of supply air diffusers and return air grilles. As well as an inspection of the Heating Ventilation Air Conditioning (HVAC) system was requested.

1.2 Scope of Work

Pinchin performed the investigation from March 8, 2022 to March 9, 2022. The scope of this investigation was limited to Room 406. As well as the HVAC system on the 100 Floor Level.

The investigation involved the following activities:

- Review site via in-person walkthrough for factors that could contribute to poor indoor air quality;
- Site review of HVAC equipment servicing the entire building; and
- Data-logging of Carbon Dioxide (CO_2), Carbon Monoxide (CO), Temperature (Temp), Relative Humidity (RH), Total Volatile Organic Compounds (TVOCs) and Particulate Matter smaller than 2.5 micrometres ($PM_{2.5}$) within Room 406.

2.0 METHODOLOGY

2.1 Interviews and Site Reviews

Pinchin interviewed the University of Manitoba Physical Plant, Project and Building Managers to discuss the history of the building, maintenance practices and any indoor air quality concerns.

The investigator did not perform any destructive work to inspect concealed conditions inside wall and/or ceiling cavities.

2.2 Test Methods and Criteria

The following table presents the parameters measured in this investigation, the instruments and sampling/analytical methods used, the applicable units of measurement, and the Indoor Air Quality criteria used for the evaluation of the results.

Table I – IAQ Parameters Tested, Measurement Criteria and Instruments

Parameter	Unit of Measurement	Recommended Limit	Instrumentation
Carbon dioxide, CO_2	Parts per million in air (ppm)	Outdoor Air (ppm) + 700 ppm [1]	24-hour Data-log Monitoring using a 3M® EVM-7 Air Quality Monitor
Carbon monoxide, CO	ppm	5 ppm [2]	
Temperature, T	°C	21 to 25 °C, winter clothing [3]	
Relative Humidity, RH	%RH	25[4] to 65[5] %, for occupant comfort	
Total Volatile Organic Compounds, (TVOC)	Parts per billion (ppb)	400 ppb[6]	
Particulate Matter smaller than 2.5 micrometres, $PM_{2.5}$	µg/m³	25 µg/m³ [7]24-hour mean;	

All data-logging direct-reading instruments were calibrated before use.

1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Ventilation for Acceptable Indoor Air Quality* [ANSI/ASHRAE Standard 62.1-2019]. Atlanta, GA: ASHRAE, 2019.
2 Health Canada: *Indoor Air Quality in Office Buildings: A Technical Guide*. Ottawa, ON: Health Canada, 1995.
3 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Thermal Environmental Conditions for Human Occupancy* [ANSI/ASHRAE Standard 55-2020]. Atlanta, GA: ASHRAE, 2020.
4 L.E. Burton, J.G. Girman, S.E. Womble: Airborne particulate matter within 100 randomly selected office buildings in the United States (BASE). Proceedings of Healthy Buildings 2000, Vol. 1 (2001).
5 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Thermal Environmental Conditions for Human Occupancy* [ANSI/ASHRAE Standard 55-2020]. Atlanta, GA:ASHRAE, 2020.
6 Value calculated from: US Environmental Protection Agency (EPA) "Building Assessment Survey and Evaluation (BASE) Study [Online] Available at http://www.epa.gov/iaq/base/summarized_data.html#Volatile_Organic_Compounds (Accessed August 25, 2014).
7 W. Team, "WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide : global update 2005 : summary of risk assessment", Apps.who.int, 2021. [Online]. Available: http://apps.who.int/iris/handle/10665/69477. [Accessed: 15-Sep- 2021].

3.0 FINDINGS

3.1 Results of Interviews

Project or Building Manager reported the following:

- Air Handling Units (AHU) filters are changed every three months or as needed;
- The occupant capacity within Room 406 is 80 people; and
- The enrollment/class ranges from 11 to 76 people.

3.2 Facility Description

Table II – Facility Description

Item	Details
Construction Date	1960
Number of Floors	Five floors above grade, one floor below grade
Structural Type	Steel
Foundation Type	Concrete
Exterior Cladding	Brick
HVAC	Forced Air
Roof	Built up
Flooring	Vinyl Floor Tile, Concrete
Interior Walls	Hollow-Core Brick, Drywall
Ceilings	Acoustic Ceiling Tile

3.3 Results of Site Reviews

Appendix I presents the drawings.

There are two Air Handling Units within the Parker Building. AHU M73 provides air to the east side of the building (Photo #1). Inside the AHU there were no leaks or standing water (Photo #2) and the filters fit properly and were observed to be clear (Photo #3)

AHU M74 provides air to the west side of the building (Photo #5). Inside the AHU there were no leaks or standing water and the filters fit properly and were observed to be clear

In the sampling location there were observed to be four supply diffusers (Photo #6) and one return grate. All supply diffusers and return grilles were clean and free from obstructions.

The filters in AHU M73 and AHU M74 are Minimum Efficiency Reporting Value (MERV) of 8.

Refer to Table III for photographs from the investigation.

Table III – Photographs from Investigation

Photo 1 - AHU M73

Photo 2 - Inside AHU M73 free from leaks and standing water

Photo 3 - AHU M73 filters (clean)

Photo 4 - AHU M73 Dampers

Photo 5 - AHU M74

Photo 6 - Room 406 supply air diffuser (clean)

3.4 Results of Indoor Air Quality Tests

Appendix II presents the results of data-logging for IAQ parameters.

The EVM 7 air monitor was used for 24-hour data logging within room 406, for $PM_{2.5}$, CO_2, CO, TVOC, Temperature, and Relative Humidity. The EVM-7 is a direct-reading and datalogging instrument and was calibrated before use.

3.4.1 Carbon Dioxide (CO_2)

The 24-hour minimum CO_2 concentration recorded within the building was 365 ppm, the maximum CO_2 concentration was 468 ppm. The 24-hour average for CO_2 was 393 ppm. The average CO_2 concentration during **the occupied time** was 422 ppm. On March 8 and March 9 outdoor spot measurements were recorded. The average outdoor CO2 spot measurements for the two days was 445 ppm . The indoor carbon dioxide concentrations were below the limit of 1145 ppm (445 ppm outdoors plus 700 ppm) recommended by American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE). This indicates that the supply of outdoor air was adequate for the occupancy loading at the time of the investigation.

3.4.2 Carbon Monoxide (CO)

The carbon monoxide concentrations were non-detectable or just at the detection limit of the instrumentation for the duration of the 24-hour datalogging. Health Canada advises that the detection of carbon monoxide above 5 ppm indicates a concern requiring further investigation.

3.4.3 Temperature (Temp)

The 24-hour minimum temperature measurement was 19.8 °C, the maximum temperature measurement was 21.8 °C. The 24-hour average temperature measurement was 21.0 °C. The average temperature measurements during **the occupied time** were 20.8 °C. On March 8 and March 9 outdoor spot measurements were taken each day, averaging -13.5 °C for these dates. The indoor temperatures were within the recommended comfort ranges for office environments for typical dress during winter conditions, of 21 to 25 °C

3.4.4 Relative Humidity (RH)

The 24-hour minimum Relative Humidity measurement was 0.6 %RH, the maximum measurement was 13.4 %RH. The 24-hour average measurement for relative humidity was 6.2 %RH. The average relative humidity measurement during **the occupied time** was 8.38 %RH. On March 8 and March 9 outdoor spot measurements were taken each day, averaging 75.5 %RH for these dates. Relative humidity below 25 %RH may result in complaints of dry skin and eye and nose irritation. Low relative humidity is a common winter time condition in Canada due to difficulties with humidification.

3.4.5 Airborne Dust ($PM_{2.5}$)

The 24-hour minimum concentration for $PM_{2.5}$ was below the detection limit of the monitoring instrument, the maximum concentration for $PM_{2.5}$ was 23 µg/m³. The 24-hour average concentration for $PM_{2.5}$ was 0.54 µg/m³. The average $PM_{2.5}$ concentrations during the occupied time was 0.84 µg/m³. On March 8 and March 9 outdoor spot measurements were taken each day, averaging 4.5 µg/m³ for these dates. For reference, World Health Organization (WHO) provides a guideline of 25 µg/m³ over a 24-hour period. The indoor $PM_{2.5}$ concentrations in this building were within the recommended range.

3.4.6 Total Volatile Organic Compounds (TVOC)

The TVOC concentrations were non-detectable or just at the detection limit of the instrumentation for the duration of the 24-hour monitoring. Based on US EPA research, office environments with TVOC concentrations up to 400 ppb would be at little risk of IAQ concern. As this is a guideline, complaints might be expected if concentrations were significantly above 400 ppb.

Table IV – Summary of 24-Hour Data-logging IAQ based on Indoor Air Quality Criteria

Parameter	Measurement Average	Indoor Air Quality Measurement Criteria	Below Indoor Air Quality Measurement Criteria?
Carbon Dioxide	393 ppm	Outdoor Air (ppm) + 700 ppm	Yes
Carbon Monoxide	0ppm	5ppm	Yes
Temperature (°C)	21 °C	21 to 25 °C, winter clothing	Yes

Table IV – Summary of 24-Hour Data-logging IAQ based on Indoor Air Quality Criteria

Relative Humidity (%)	6.2% RH	25 to 65 %, for occupant comfort	No
$PM_{2.5}$	0.54 µg/m³	25 µg/m³	Yes
TVOC	**Below the Detection Limit of the Monitoring Instrument**	400 ppb	Yes

4.0 DISCUSSION

The majority of the indoor air quality measurements collected were within recommended ranges and meet the criteria of the guidelines referenced. Carbon dioxide concentrations suggested adequate ventilation. Carbon monoxide concentrations did not suggest the presence of exhaust or combustion gases. Temperature measurements were within the recommended comfort ranges for office environments. $PM_{2.5}$ concentrations were within typical ranges. Total Volatile Organic Compound (TVOC) concentrations were within the recommended range. As well the Pinchin inspector did not identify any deficiencies with regards to unusual odours during the investigation.

Relative Humidity measurements were below the recommended comfort range which may result in dry skin, eye and nose irritation. However, it should be noted that low relative humidity is a common wintertime condition in Canada.

Pinchin inspected the Air Handling Units (AHUs) and concluded that the AHUs are in proper working order with no leaks or standing water build up. The filters in AHU M74 and M75 were clean and free of visible dust and debris.

5.0 RECOMMENDATIONS

Pinchin offers the following recommendations to improve air quality in this building.

1. Communicate the findings of this report to the staff, and health and safety representitive; and
2. Review the humidification system in the building to ensure it is operational and functioning properly. Consider making adjustments as necessary.

6.0 TERMS AND LIMITATIONS

This work was performed subject to the Terms and Limitations presented or referenced in the proposal for this project.

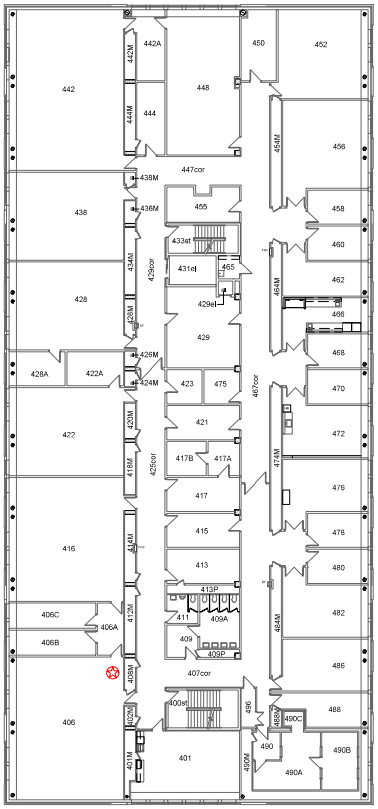
Information provided by Pinchin is intended for Client use only. Pinchin will not provide results or information to any party unless disclosure by Pinchin is required by law. Any use by a third party of reports or documents authored by Pinchin or any reliance by a third party on or decisions made by a third party based on the findings described in said documents, is the sole responsibility of such third parties. Pinchin accepts no responsibility for damages suffered by any third party as a result of decisions made or actions conducted. No other warranties are implied or expressed.

\\pinchin.com\wpg\Job\306000s\0306866.000 UofM,89FREEDMAN,IAQ,ASSMNT\Deliverables\Parker\306866.000 Final IAQ Report, Parker, 144 Dysart Rd , Wpg, MB, UofM, Mar 31, 2022.docx

Template: Master Report Investigation of IAQ, IEQ, September 15, 2021

APPENDIX I

Drawing(s)



LEGEND

DATA LOGGING LOCATION

PINCHIN

PROJECT NAME:
INDOOR AIR QUALITY ASSESSMENT

CLIENT NAME:
UNIVERSITY OF MANITOBA

PROJECT LOCATION:
PARKER BUILDING
144 DYSART ROAD
WINNIPEG, MANITOBA

FIGURE NAME:
FOURTH FLOOR

PROJECT NUMBER:	SCALE:
306866	NTS
DRAWN BY:	REVIEWED BY:
JCV	BJA
DATE:	FIGURE NUMBER:
MAR 2022	1 OF 1

APPENDIX II

Results of Data-Logging Indoor Air Quality Measurements

Session Report
144 Dysart Road
Parker Building

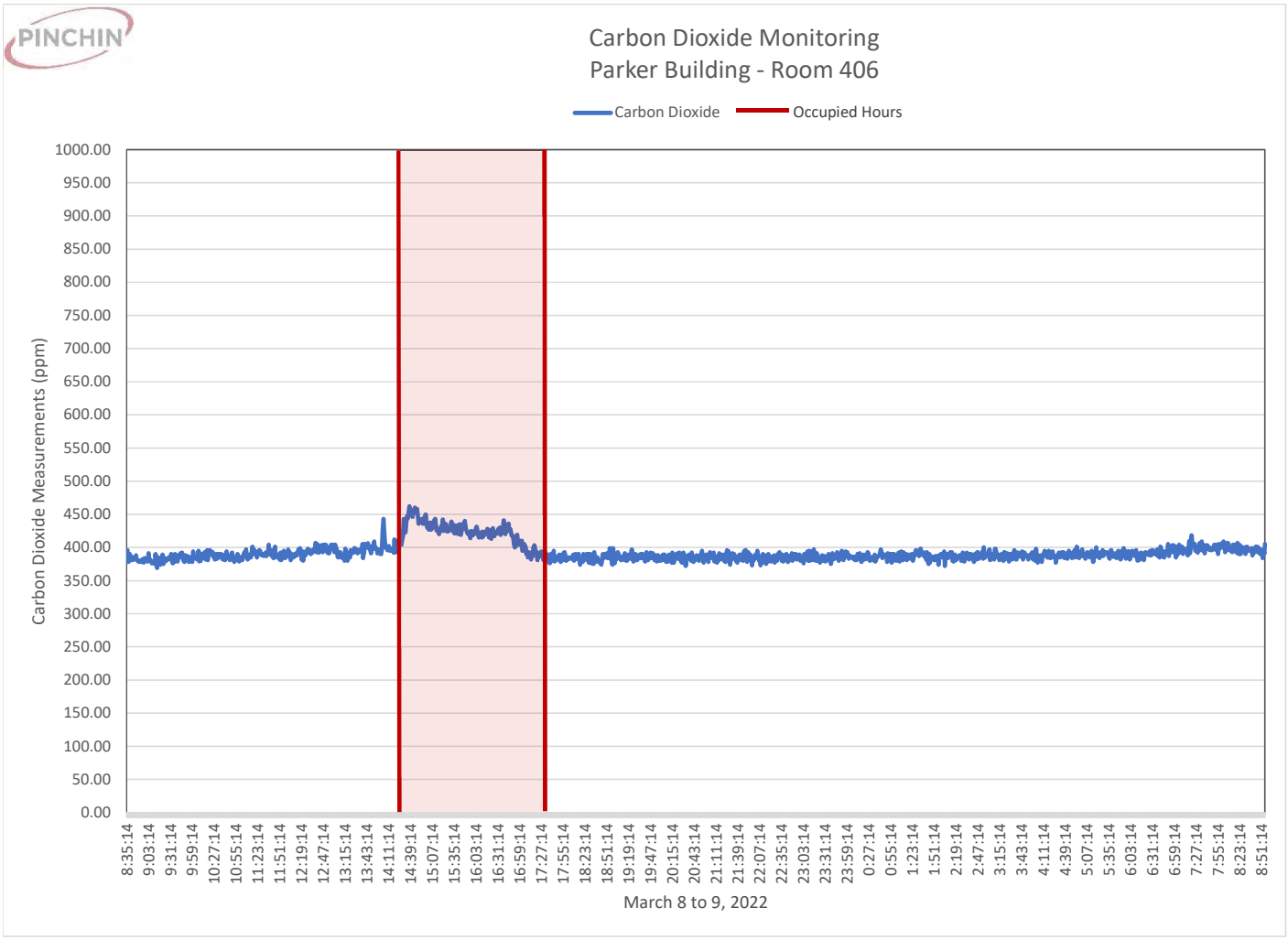
3/8/2022

Datalog Period

Device Name	EML090039
Serial Number	EML090039
Run Time	1.00:19:55
Start Time	3/8/2022 8:34:14 AM
Stop Time	3/9/2022 8:54:09 AM

IAQ Data Summary

Description	Value	Description	Value
CO2Ave	393 PPM	CO2Max	468 PPM
CO2MaxTime	3/8/2022 2:45:09 PM	CO2Min	365 PPM
COAve	0 PPM	COMax	0 PPM
COMin	0 PPM	Dust Average	0.000 ug/m³
Dust Max	223.000 ug/m³	Dust Min	0.000 ug/m³
Humidity Avg	6.2 %	Humidity Max	13.4 %
Humidity Max Time	3/8/2022 8:34:26 AM	Humidity Min	0.6 %
Humidity Min Time	3/9/2022 8:48:18 AM	PIDAvePPB	Below Detection limit of Device
PIDMaxPPB	Below Detection limit of Device	PIDMinPPB	Below Detection limit of Device
Temp Avg	21 °C	Temp Max Time	3/8/2022 10:37:49 AM
Temp Min Time	3/8/2022 8:34:14 AM	Temperature Max	21.8 °C
Temperature Min	19.8 °C		
Dust Impactor Setting	2.5 µm		


PINCHIN
Carbon Dioxide Monitoring
Parker Building - Room 406
Carbon Dioxide
Occupied Hours
Carbon Dioxide Measurements (ppm)
1000.00
950.00
900.00
850.00
800.00
750.00
700.00
650.00
600.00
550.00
500.00
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
8:35:14
9:03:14
9:31:14
9:59:14
10:27:14
10:55:14
11:23:14
11:51:14
12:19:14
12:47:14
13:15:14
13:43:14
14:11:14
14:39:14
15:07:14
15:35:14
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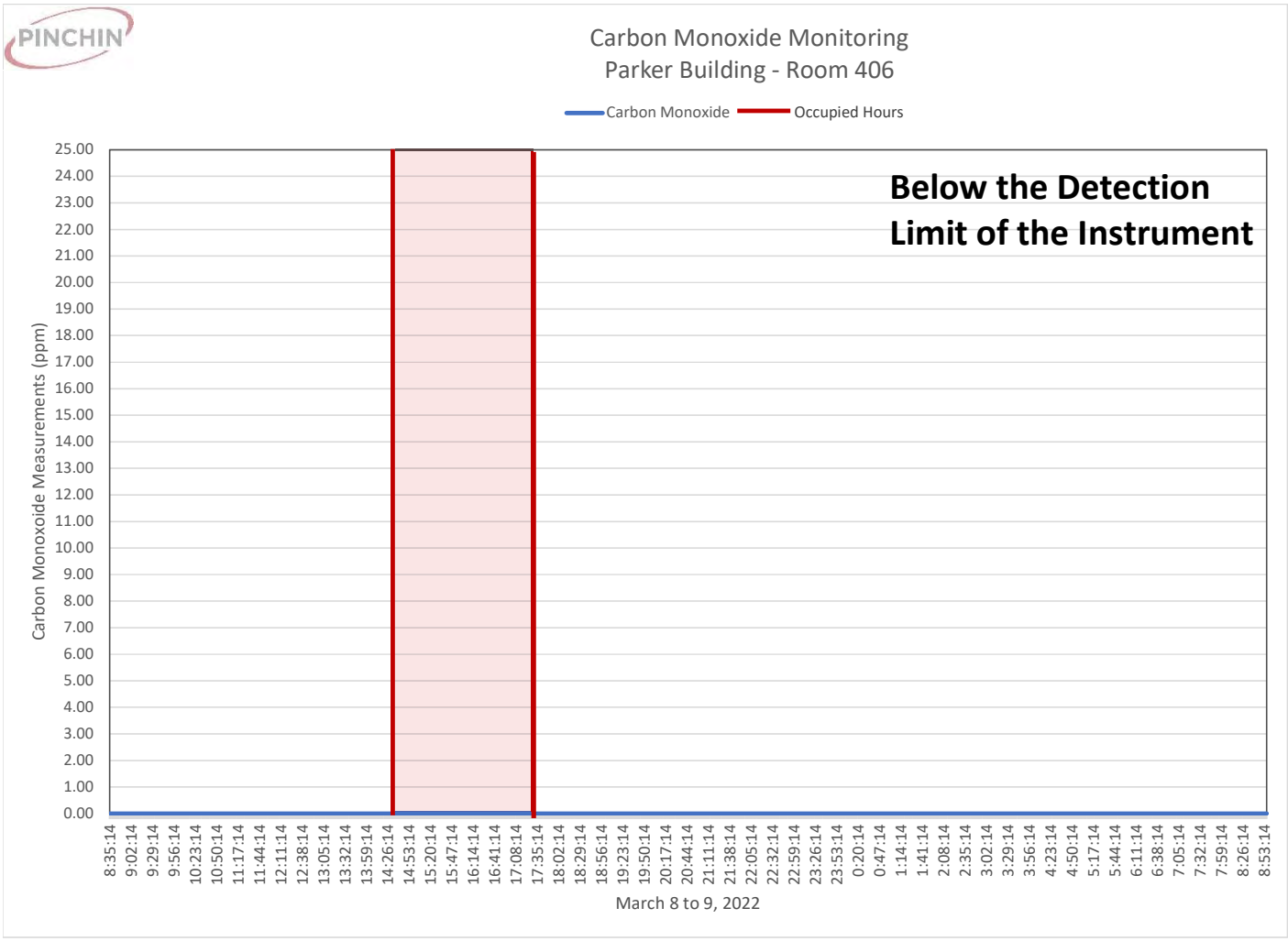
8:51:14
March 8 to 9, 2022


PINCHIN
Carbon Monoxide Monitoring
Parker Building - Room 406
Carbon Monoxide
Occupied Hours
Below the Detection Limit of the Instrument
Carbon Monoxide Measurements (ppm)
25.00
24.00
23.00
22.00
21.00
20.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
8:35:14
9:02:14
9:29:14
9:56:14
10:23:14
10:50:14
11:17:14
11:44:14
12:11:14
12:38:14
13:05:14
13:32:14
13:59:14
14:26:14
14:53:14
15:20:14
15:47:14
16:14:14
16:41:14
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18:02:14
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18:56:14
19:23:14
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20:17:14
20:44:14
21:11:14
21:38:14
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22:59:14
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23:53:14
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1:41:14
2:08:14
2:35:14
3:02:14
3:29:14
3:56:14
4:23:14
4:50:14
5:17:14
5:44:14
6:11:14
6:38:14
7:05:14
7:32:14
7:59:14
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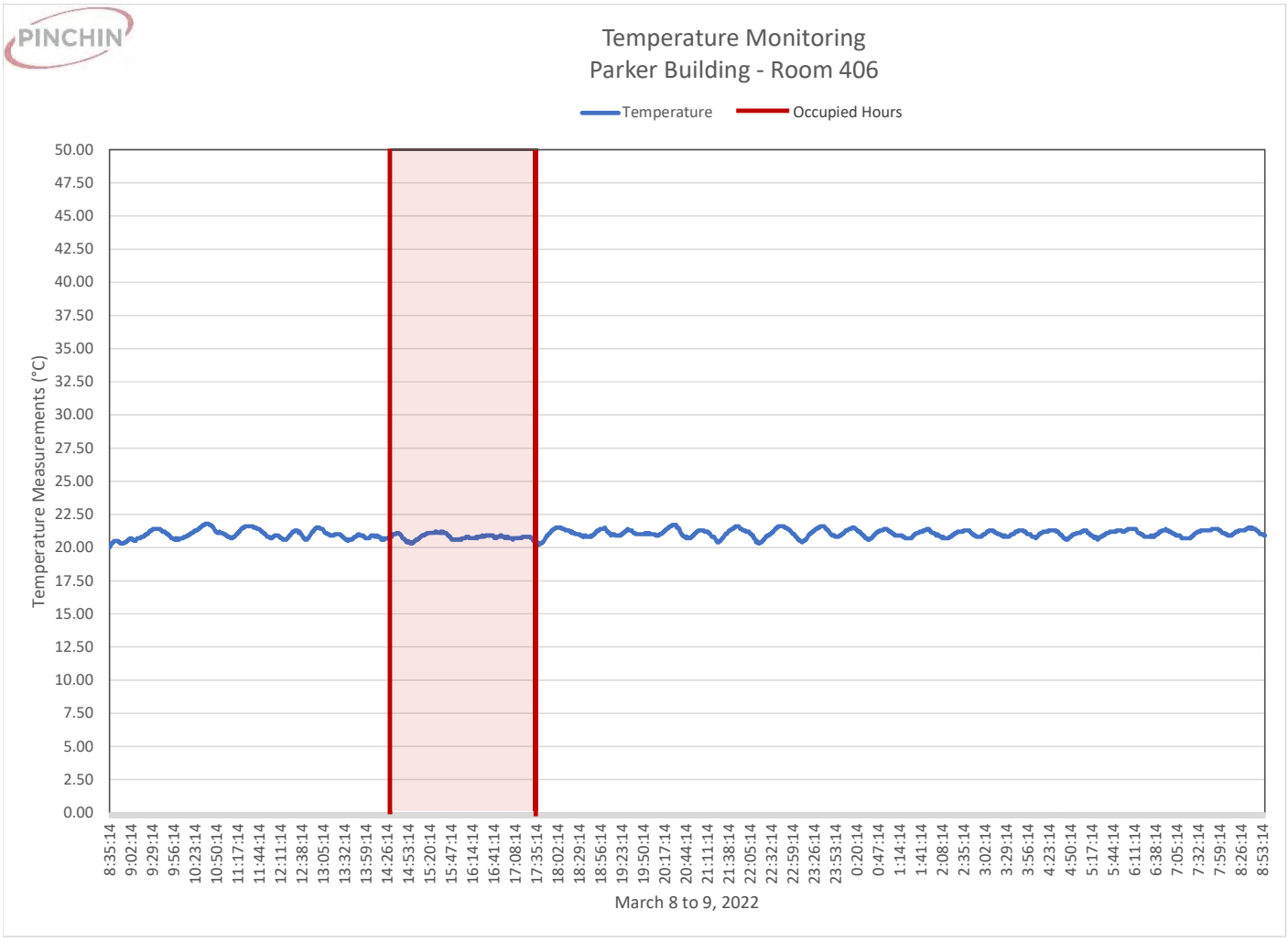
8:53:14
March 8 to 9, 2022


PINCHIN
Temperature Monitoring
Parker Building - Room 406
Temperature
Occupied Hours
Temperature Measurements (°C)
50.00
47.50
45.00
42.50
40.00
37.50
35.00
32.50
30.00
27.50
25.00
22.50
20.00
17.50
15.00
12.50
10.00
7.50
5.00
2.50
0.00
8:35:14
9:02:14
9:29:14
9:56:14
10:23:14
10:50:14
11:17:14
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12:11:14
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13:59:14
14:26:14
14:53:14
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1:41:14
2:08:14
2:35:14
3:02:14
3:29:14
3:56:14
4:23:14
4:50:14
5:17:14
5:44:14
6:11:14
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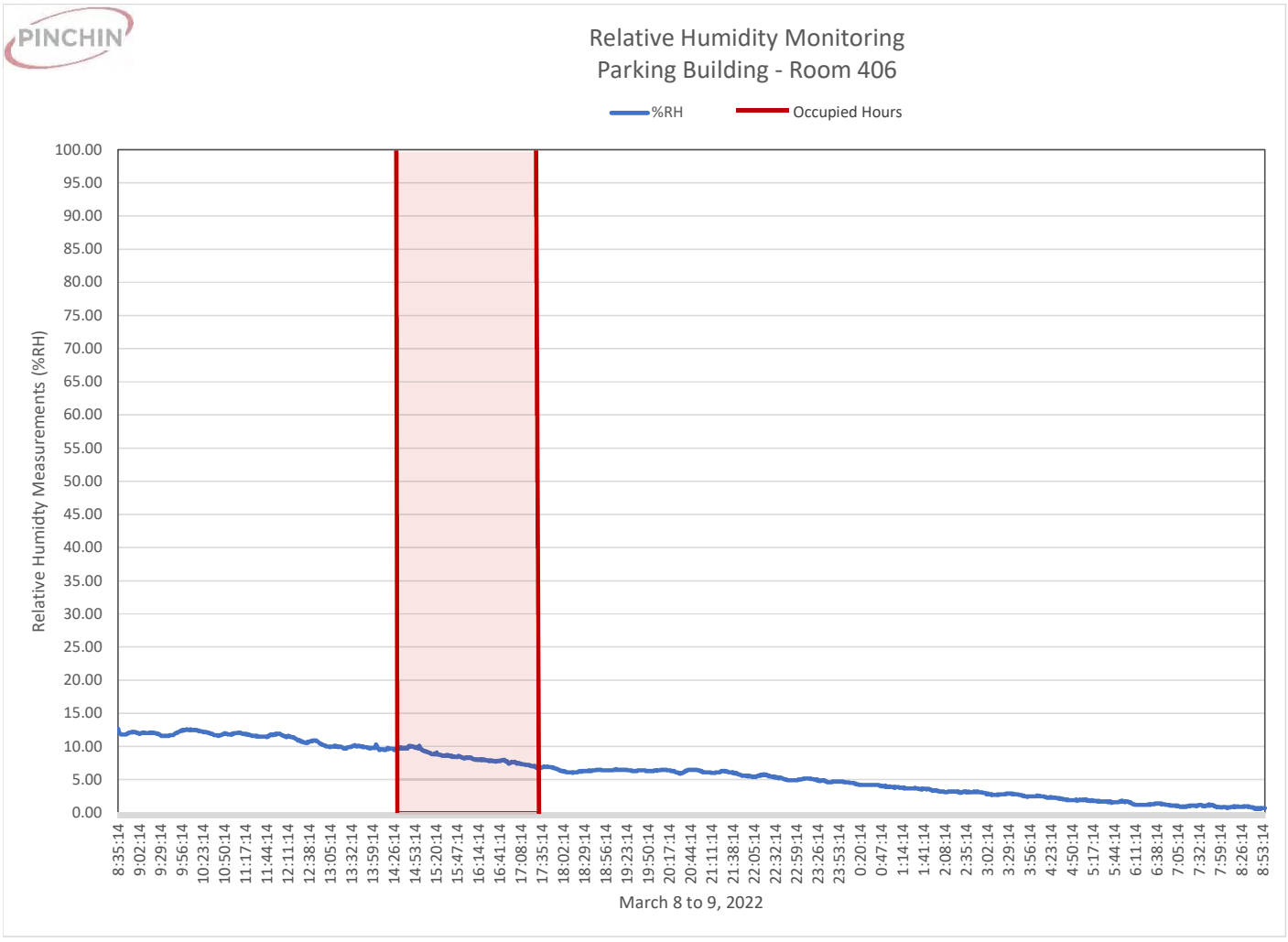
8:53:14
March 8 to 9, 2022


PINCHIN
Relative Humidity Monitoring
Parking Building - Room 406
%RH
Occupied Hours
Relative Humidty Measurements (%RH)
100.00
95.00
90.00
85.00
80.00
75.00
70.00
65.00
60.00
55.00
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
8:35:14
9:02:14
9:29:14
9:56:14
10:23:14
10:50:14
11:17:14
11:44:14
12:11:14
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13:05:14
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5:17:14
5:44:14
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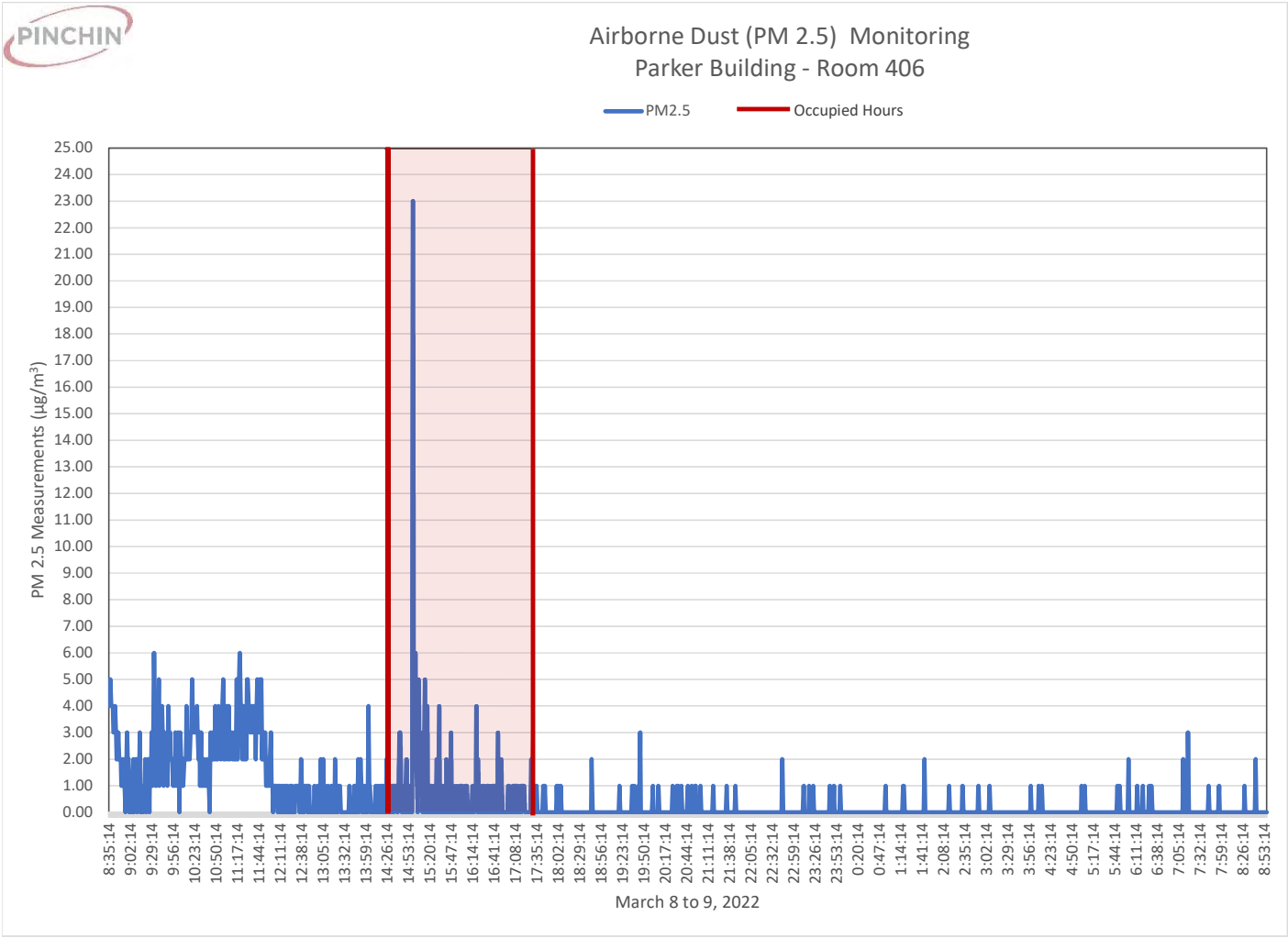
7:59:14
8:26:14
8:53:14
March 8 to 9, 2022


PINCHIN
Airborne Dust (PM 2.5) Monitoring
Parker Building - Room 406
PM2.5
Occupied Hours
PM 2.5 Measurements (µg/m³)
25.00
24.00
23.00
22.00
21.00
20.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
8:35:14
9:02:14
9:29:14
9:56:14
10:23:14
10:50:14
11:17:14
11:44:14
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17:08:14
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5:44:14
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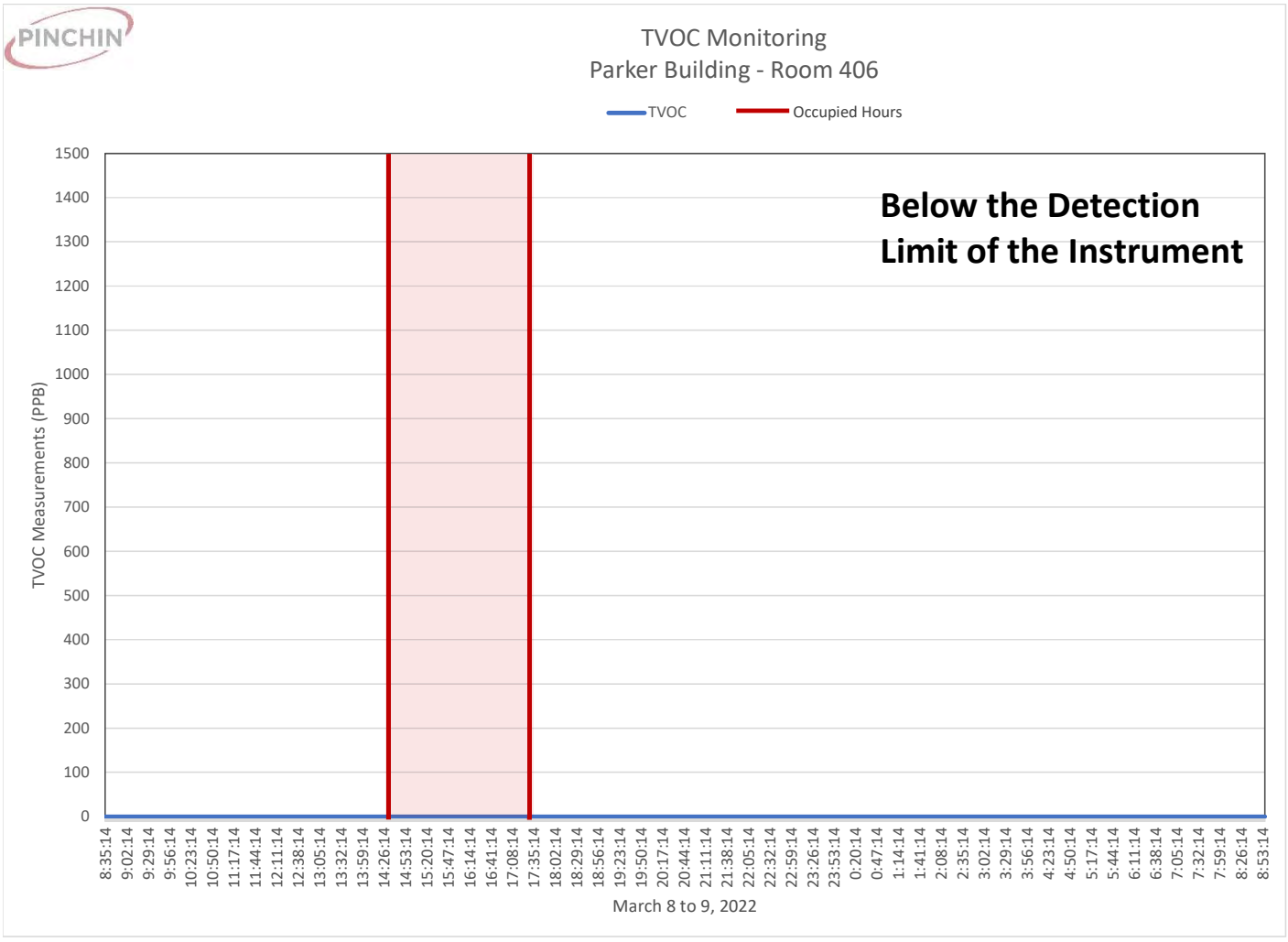
8:26:14
8:53:14
March 8 to 9, 2022


PINCHIN
TVOC Monitoring
Parker Building - Room 406
TVOC
Occupied Hours
Below the Detection Limit of the Instrument
TVOC Measurements (PPB)
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
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1:41:14
2:08:14
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4:23:14
4:50:14
5:17:14
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6:11:14
6:38:14
7:05:14
7:32:14
7:59:14
8:26:14
8:53:14
March 8 to 9, 2022

FINAL

Investigation of Indoor Air Quality

Robson Hall
224 Dysart Road, Winnipeg, Manitoba

Prepared for:

University of Manitoba
120 Physical Plant,
89 Freedman Crescent
Winnipeg, Manitoba, R3T 2N2

March 31, 2022

Pinchin File: 306866

Issued to: **University of Manitoba**
Issued on: **March 31, 2022**
Pinchin File: **306866**
Issuing Office: **Winnipeg, MB**

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EXECUTIVE SUMMARY

Pinchin Ltd. (Pinchin) was retained by University of Manitoba (the Client) to conduct an investigation of indoor air quality (IAQ) that included 24-hour monitoring. The work was conducted at 224 Dysart Road, Winnipeg, Manitoba. Room 204 of the Robson Hall Building was the data logging location chosen by the client as it was occupied by staff and students during the hours of 09:00-11:50, 13:00-15:50, and 16:00-18:50. Room 204 is located on the main floor of the Robson Hall Building at the Fort Garry campus. The client also requested that in locations where the 24-hour monitoring occurred, observations be made specifically to the cleanliness of supply air diffusers and return air grilles.

Along with the 24-hour monitoring in Room 204 the client requested an inspection of the Heating Ventilation Air Conditioning (HVAC) system to determine if there were conditions present that could degrade air quality, i.e., dirty or wrongly fitted filters, presence of moisture, etc.

The majority of the indoor air quality measurements collected were within recommended ranges and meet the criteria of the guidelines referenced. Carbon dioxide concentrations suggested adequate ventilation. Carbon monoxide concentrations did not suggest the presence of exhaust or combustion gases. $PM_{2.5}$ concentrations were within typical ranges. Total Volatile Organic Compound (TVOC) concentrations were within the recommended range. The Pinchin inspector did not identify any deficiencies with regards to unusual odours during the investigation.

Temperature measurements were above the recommended comfort range for occupants in typical winter dress. Temperature preferences are, however, very personal and these conditions might be acceptable to the occupants.

Relative Humidity measurements were below the recommended comfort range which may result in dry skin, eye and nose irritation. However, it should be noted that low relative humidity is a common wintertime condition in Canada.

Pinchin inspected the Air Handling Units (AHUs) and concluded that the AHUs are in proper working order with no leaks or standing water build up. The filters in the AHU were clean and free of visible dust and debris

The following recommendations are offered to improve air quality in this building:

1. Communicate the findings of this report to the staff, and health and safety representitive;
2. Review the humidification system in the building to ensure it is operational and functioning properly. Consider making adjustments as necessary; and
3. Review the temperature set points in the building to ensure the HVAC system is functioning properly. Consider making adjustments as necessary.

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1.0 INTRODUCTION AND SCOPE

1.1 Statement of Understanding

Pinchin Ltd. (Pinchin) was retained by University of Manitoba (the Client) to conduct an investigation of indoor air quality (IAQ) that included 24-hour monitoring. The work was conducted at 224 Dysart Road, Winnipeg, Manitoba. Room 204 of the Robson Hall Building was the data logging location chosen by the client as it was fully occupied by staff and students throughout the daytime hours. Room 204 is located on the man floor of the Robson Hall Building at the Fort Garry campus. The client also requested that at this location, observations be made specifically to the cleanliness of supply air diffusers and return air grilles. As well an inspection of the Heating Ventilation Air Conditioning (HVAC) system was requested.

1.2 Scope of Work

Pinchin performed the investigation from March 9 to March 10, 2022. The scope of this investigation was limited to Room 204. As well as the HVAC system on the 100 level.

The investigation involved the following activities:

- Review site via in-person walkthrough for factors;
- Site review of HVAC equipment servicing the entire building; AND
- Data-logging of Carbon Dioxide (CO_2), Carbon Monoxide (CO), Temperature (Temp), Relative Humidity (RH), Total Volatile Organic Compounds (TVOCs) and Particulate Matter smaller than 2.5 micrometres ($PM_{2.5}$) within Room 204.

2.0 METHODOLOGY

2.1 Interviews and Site Reviews

Pinchin interviewed the University of Manitoba Physical Plant, Project and Building Managers to discuss the history of the building, maintenance practices and any indoor air quality concerns.

The investigator did not perform any destructive work to inspect concealed conditions inside wall and/or ceiling cavities.

2.2 Test Methods and Criteria

The following table presents the parameters measured in this investigation, the instruments and sampling/analytical methods used, the applicable units of measurement, and the Indoor Air Quality criteria used for the evaluation of the results.

Table I – IAQ Parameters Tested, Measurement Criteria and Instruments

Parameter	Unit of Measurement	Recommended Limit	Instrumentation
Carbon dioxide, CO_2	Parts per million in air (ppm)	Outdoor Air (ppm) + 700 ppm[1]	24-hour Data-log Monitoring using a 3M® EVM-7 Air Quality Monitor
Carbon monoxide, CO	ppm	5 ppm[2]	
Temperature, T	°C	21 to 25 °C, winter clothing[3]	
Relative Humidity, RH	%RH	25[4] to 65[5] %, for occupant comfort	
Total Volatile Organic Compounds, (TVOC)	Parts per billion (ppb)	400 ppb [6]	
Particulate Matter smaller than 2.5 micrometres, $PM_{2.5}$	µg/m³	25 µg/m³ [7], 24-hour mean	

All data-logging direct-reading instruments were calibrated before use.

3.0 FINDINGS

3.1 Results of Interviews

Project or Building Manager reported the following:

- Air Handling Units (AHU) filters are changed every three months or as needed;
- The occupant capacity within Room 204 is 53 people; AND
- The enrollment/class ranges from 13 to 31 people.

1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Ventilation for Acceptable Indoor Air Quality* [ANSI/ASHRAE Standard 62.1-2019]. Atlanta, GA: ASHRAE, 2019.
2 Health Canada: *Indoor Air Quality in Office Buildings: A Technical Guide*. Ottawa, ON: Health Canada, 1995.
3 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Thermal Environmental Conditions for Human Occupancy* [ANSI/ASHRAE Standard 55-2020]. Atlanta, GA: ASHRAE, 2020.
4 L.E. Burton, J.G. Girman, S.E. Womble: Airborne particulate matter within 100 randomly selected office buildings in the United States (BASE). Proceedings of Healthy Buildings 2000, Vol. 1 (2001).
5 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Thermal Environmental Conditions for Human Occupancy* [ANSI/ASHRAE Standard 55-2020]. Atlanta, GA:ASHRAE, 2020.
6 Value calculated from: US Environmental Protection Agency (EPA) "Building Assessment Survey and Evaluation (BASE) Study [Online] Available at http://www.epa.gov/iaq/base/summarized_data.html#Volatile_Organic_Compounds (Accessed August 25, 2014).
7 W. Team, "WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide : global update 2005 : summary of risk assessment", Apps.who.int, 2021. [Online]. Available: http://apps.who.int/iris/handle/10665/69477. [Accessed: 15- Sep- 2021].

3.2 Facility Description

Table II – Facility Description

Item	Details
Construction Date	1969
Number of Floors	Three floors above grade, one floor below grade
Structural Type	Steel
Foundation Type	Concrete
Exterior Cladding	Brick
HVAC	Forced Air
Roof	Built up
Flooring	Concrete, Carpet
Interior Walls	Concrete, Drywall, Brick,
Ceilings	Acoustic Ceiling Tiles

3.3 Results of Site Reviews

Appendix I presents the drawings.

There is one Air Handling Unit within Robson Hall. The AHU provides air to the entire building using seven separate fans. Fan 1 is the return air fan (Photo #1), Fan 2 provides air to the north side of the 1st floor (Photo #2), Fan 3 provides air to the south side of the library, Fan 4 provides air to the south side of the 1st floor, Fan 5 provides air to north side of the library, Fan 6 provides air to the south side of the 2nd floor, and Fan 7 provides air to the north side of the 3rd floor (Photo #3). Inside the AHU there were no leaks found or standing water (Photo #5 and #6) and the filters fit properly and were observed to be clean (Photo #3). The condensate drain was free from any leaks and/or standing water (Photo #4).

In the sampling location there were observed to be six supply diffusers (Photo #7) and one return grate (Photo #8). All supply diffusers and return grates are clean and free from obstructions.

The filters in the AHU are Minimum Efficiency Reporting Value (MERV) of 8.

Refer to Table III for photographs from the investigation.

Table III – Photographs from Investigation

Photo 1 - Side of Fan 1

Photo 2 - Fan 2 of the AHU

Photo 3 - Fan 7 of the AHU

Photo 4 - AHU filters (clean)

Photo 5 - Inside of the AHU free from leaks and standing water

Photo 6 - Inside of the AHU free from leaks and standing water

Table III – Photographs from Investigation

Photo 7 - Room 204 supply diffuser

Photo 8 - Room 204 return grate

3.4 Results of Indoor Air Quality Tests

Appendix II presents the results of data-logging for IAQ parameters.

The EVM 7 air monitor was used for 24-hour data logging within Room 204, of $PM_{2.5}$, CO_2, CO, TVOC, Temperature, and Relative Humidity. The EVM-7 is a direct-reading and datalogging instrument and was calibrated before use.

3.4.1 Carbon Dioxide (CO_2)

The 24-hour minimum CO_2 concentration recorded within the building was 373 ppm, the maximum CO_2 concentration was 610 ppm. The 24-hour average for CO_2 was 432 ppm. The average CO_2 concentration during **the occupied time** was 472 ppm. On March 9 and March 10 outdoor spot measurements were recorded. The average outdoor CO2 spot measurements for the two days was 423 ppm. The indoor Carbon Dioxide concentrations were below the limit of 1123 ppm (423 ppm outdoors plus 700 ppm) recommended by American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) to provide indoor air quality acceptable to the majority of occupants. This indicates that the supply of outdoor air was adequate for the occupancy loading at the time of the investigation.

3.4.2 Carbon Monoxide (CO)

The 24-hour minimum concentration for CO was below the detection limit of the monitoring instrument, the maximum CO concentration was 1ppm. The 24-hour average for CO was 0.36 ppm. The average CO_2 concentration during **the occupied time** was 0.66 ppm. On March 9 and March 10 outdoor spot measurements were recorded. The average outdoor CO spot measurements for the two days was below the detection limit of the monitoring instrument. Health Canada advises that the detection of carbon monoxide above 5 ppm indicates a concern requiring further investigation.

3.4.3 Temperature (Temp)

The 24-hour minimum Temperature measurement was 19 °C, the maximum Temperature measurement was 26.3 °C. The 24-hour average Temperature measurement was 25.8 °C. The average Temperature measurements during **the occupied time** was 26.05 °C. On March 9 and March 10 outdoor spot measurements were taken each day, averaging -19.5 °C for these dates. The 24-hour average indoor Temperatures were within the recommended comfort ranges for office environments for typical dress during winter conditions, of 21 to 25 °C. The indoor Temperatures during occupied hours were outside the recommended comfort ranges for office environments for typical dress during winter conditions, of 21 to 25 °C. Temperature preferences are, however, very personal and these conditions might be acceptable to the occupants.

3.4.4 Relative Humidity (RH)

The 24-hour minimum Relative Humidity measurement was 11.2 %RH, the maximum Relative Humidity measurement was 20.3%RH. The 24-hour average measurement for relative humidity was 12.3 %RH. The average relative humidity measurement during **the occupied time** was 12.8 %RH. On March 9 and March 10 outdoor spot measurements were taken each day, averaging 64 %RH for these dates. Relative humidity below 25 %RH may result in complaints of dry skin and eye and nose irritation. Low relative humidity is a common winter time condition in Canada due to difficulties maintaining proper humidification.

3.4.5 Airborne Dust ($PM_{2.5}$)

The 24-hour minimum concentration for $PM_{2.5}$ was below the detection limit of the monitoring instrument, the maximum concentration for $PM_{2.5}$ was 24 µg/m³. The 24-hour average concentration for $PM_{2.5}$ was 0.21 µg/m³. The average $PM_{2.5}$ concentrations during **the occupied time** was 0.19 µg/m³. On March 9 and March 10 outdoor spot measurements were taken each day, averaging 26 µg/m³ for these dates. For reference, World Health Organization (WHO) provides a guideline of 25 µg/m³ over a 24-hour period. The indoor $PM_{2.5}$ concentrations in this building were within the recommended range.

3.4.6 Total Volatile Organic Compounds (TVOC)

The TVOC concentrations were non-detectable or just at the detection limit of the instrumentation for the duration of the 24-hour monitoring. Based on US EPA research, office environments with TVOC concentrations up to 400 ppb would be at little risk of IAQ concern. As this is a guideline, complaints might be expected if concentrations were significantly above 400 ppb.

Table IV – Summary of 24-Hour Data-logging IAQ based on Indoor Air Quality Criteria

Parameter	Measurement Average	Indoor Air Quality Measurement Criteria	Below Indoor Air Quality Measurement Criteria?
Carbon Dioxide	432 ppm	Outdoor Air (ppm) + 700 ppm	Yes
Carbon Monoxide	0.36 ppm	5ppm	Yes
Temperature (°C)	25.8 °C	21 to 25 °C, winter clothing	No
Relative Humidity (%)	12.26% RH	25 to 65 %, for occupant comfort	No
$PM_{2.5}$	0.21 µg/m³	25 µg/m³	Yes
TVOC	**Below the Detection Limit of the Monitoring Instrument**	400 ppb	Yes

4.0 DISCUSSION

The majority of the indoor air quality measurements collected were within recommended ranges and meet the criteria of the guidelines referenced. Carbon dioxide concentrations suggested adequate ventilation. Carbon monoxide concentrations did not suggest the presence of exhaust or combustion gases. $PM_{2.5}$ concentrations were within typical ranges. Total Volatile Organic Compound (TVOC) concentrations were within the recommended range. The Pinchin inspector did not identify any deficiencies with regards to unusual odours during the investigation.

Temperature measurements were above the recommended comfort range for occupants in typical winter dress. Temperature preferences are, however, very personal and these conditions might be acceptable to the occupants.

Relative humidity measurements were below the recommended comfort range which may result in dry skin, eye and nose irritation. However, it should be noted that low relative humidity is a common wintertime condition in Canada.

Pinchin inspected the Air Handling Units (AHUs) and indicated that the AHUs are in proper working order with no leaks or standing water build up. The filters in the AHU were clean and free of visible dust and debris

5.0 RECOMMENDATIONS

Pinchin offers the following recommendations to improve air quality in this building:

1. Communicate the findings of this report to the staff, and health and safety representitive;
2. Review the humidification system in the building to ensure it is operational and functioning properly. Consider making adjustments as necessary; and
3. Review the temperature set points in the building to ensure the HVAC system is functioning properly. Consider making adjustments as necessary.

6.0 TERMS AND LIMITATIONS

This work was performed subject to the Terms and Limitations presented or referenced in the proposal for this project.

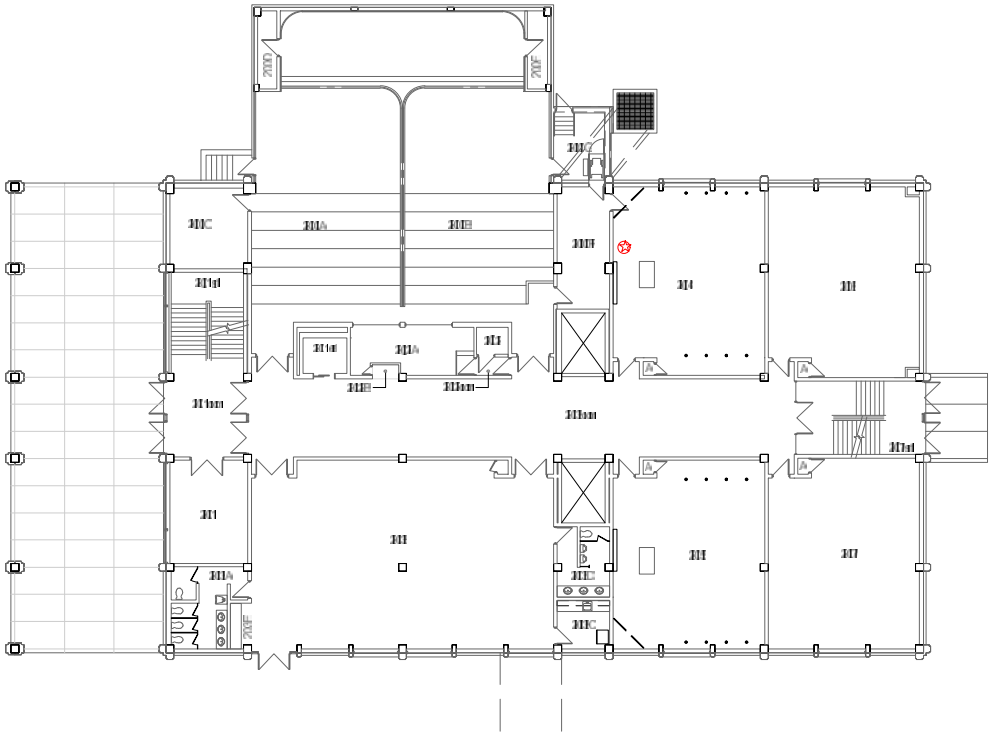
Information provided by Pinchin is intended for Client use only. Pinchin will not provide results or information to any party unless disclosure by Pinchin is required by law. Any use by a third party of reports or documents authored by Pinchin or any reliance by a third party on or decisions made by a third party based on the findings described in said documents, is the sole responsibility of such third parties. Pinchin accepts no responsibility for damages suffered by any third party as a result of decisions made or actions conducted. No other warranties are implied or expressed.

\\pinchin.com\wpg\Job\306000s\0306866.000 UofM,89FREEDMAN,IAQ,ASSMNT\Deliverables\Robson Hall\306866.000 Final IAQ Report, Robson Hall, 224 Dysart Rd, Wpg, MB, UofM, March 31, 2022.docx

Template: Master Report Investigation of IAQ, IEQ, September 15, 2021

APPENDIX I

Drawing(s)



N

LEGEND

DATA LOGGING LOCATION

PINCHIN

PROJECT NAME:
Indoor Air Quality Assessment

CLIENT NAME:
University Of Manitoba

PROJECT LOCATION:
Robson Hall Building
224 Dysart Road
Winnipeg, Manitoba

FIGURE NAME:
Second Floor

PROJECT NUMBER:	SCALE:
306866	NTS
DRAWN BY:	REVIEWED BY:
BJA	JB
DATE:	FIGURE NUMBER:
March 2022	1 OF 1

APPENDIX II

Results of Data-Logging Indoor Air Quality Measurements

Session Report
224 Dysart Road
Robson Hall

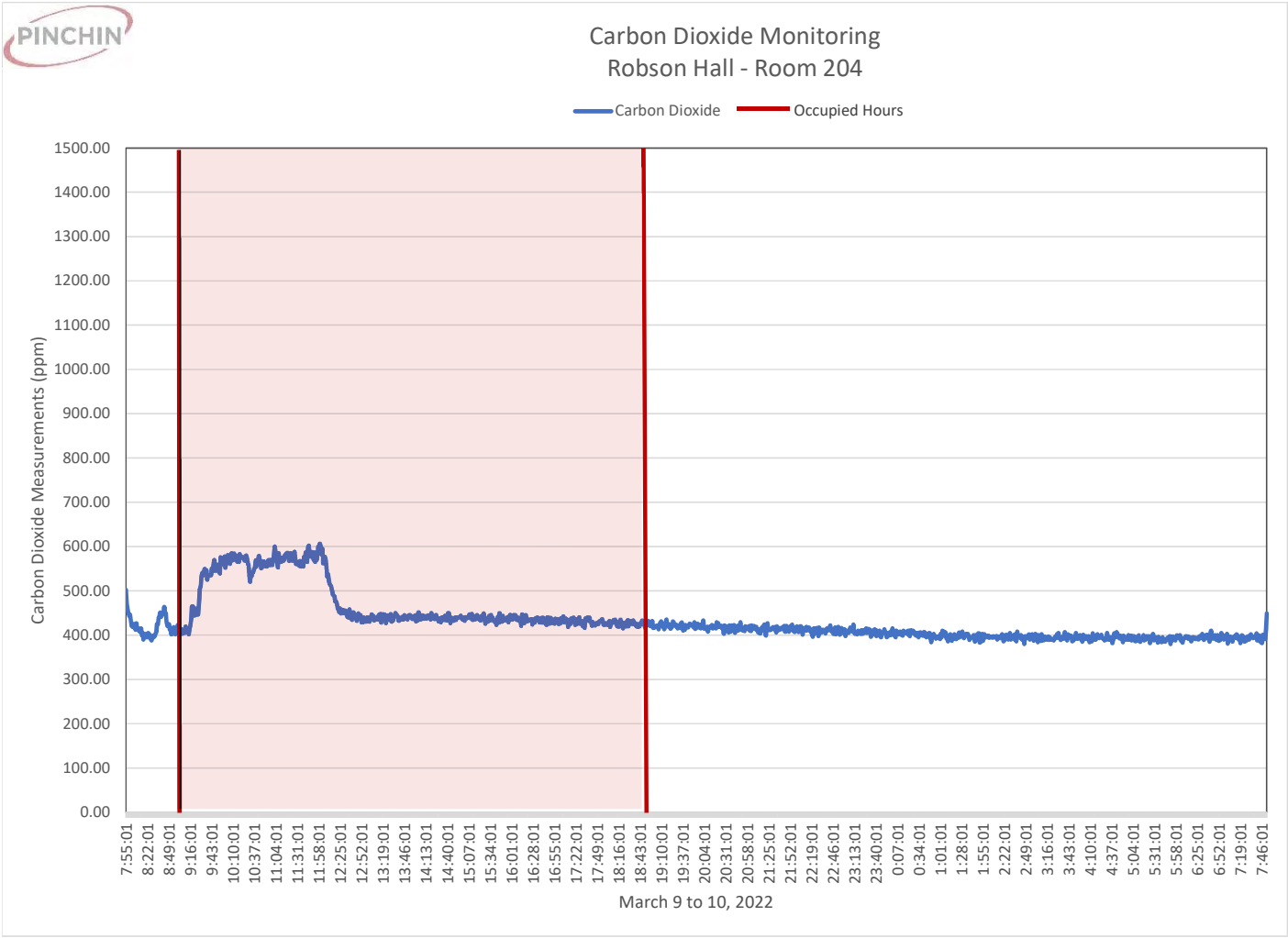
3/9/2022

Datalog Period

Device Name	EMP070003
Serial Number	EMP070003
Run Time	23:56:22
Start Time	3/9/2022 7:54:01 AM
Stop Time	3/10/2022 7:50:23 AM

IAQ Data Summary

Description	Value	Description	Value
CO2Ave	432 PPM	CO2Max	610 PPM
CO2MaxTime	3/9/2022 11:59:35 AM	CO2Min	373 PPM
COAve	0 PPM	COMax	1 PPM
COMin	0 PPM	Dust Average	0.000 ug/m³
Dust Max	24.000 ug/m³	Dust Min	0.000 ug/m³
Humidity Avg	12.3 %	Humidity Max	20.3 %
Humidity Max Time	3/9/2022 7:54:23 AM	Humidity Min	11.2 %
Humidity Min Time	3/10/2022 7:48:14 AM	PIDAvePPB	Below Detection limit of Device
PIDMaxPPB	Below Detection limit of Device	PIDMinPPB	Below Detection limit of Device
Temp Avg	25.8 °C	Temp Max Time	3/9/2022 12:02:58 PM
Temp Min Time	3/9/2022 7:54:00 AM	Temperature Max	26.3 °C
Temperature Min	18.3 °C		
Dust Impactor Setting	2.5 µm		


PINCHIN
Carbon Dioxide Monitoring
Robson Hall - Room 204
Carbon Dioxide
Occupied Hours
Carbon Dioxide Measurements (ppm)
1500.00
1400.00
1300.00
1200.00
1100.00
1000.00
900.00
800.00
700.00
600.00
500.00
400.00
300.00
200.00
100.00
0.00
7:55:01
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3:16:01
3:43:01
4:10:01
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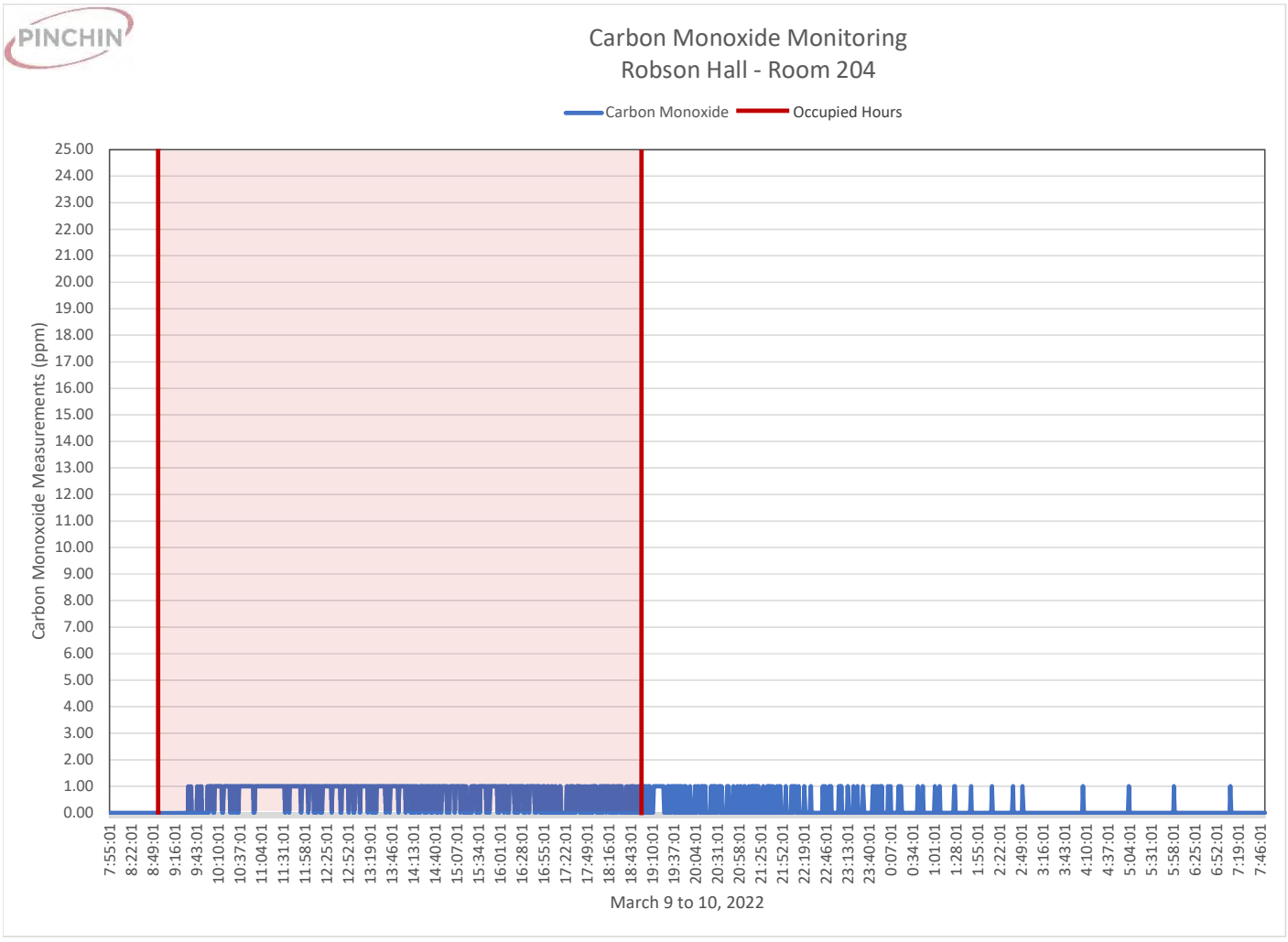
7:46:01
March 9 to 10, 2022


PINCHIN
Carbon Monoxide Monitoring
Robson Hall - Room 204
Carbon Monoxide
Occupied Hours
Carbon Monoxide Measurements (ppm)
25.00
24.00
23.00
22.00
21.00
20.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
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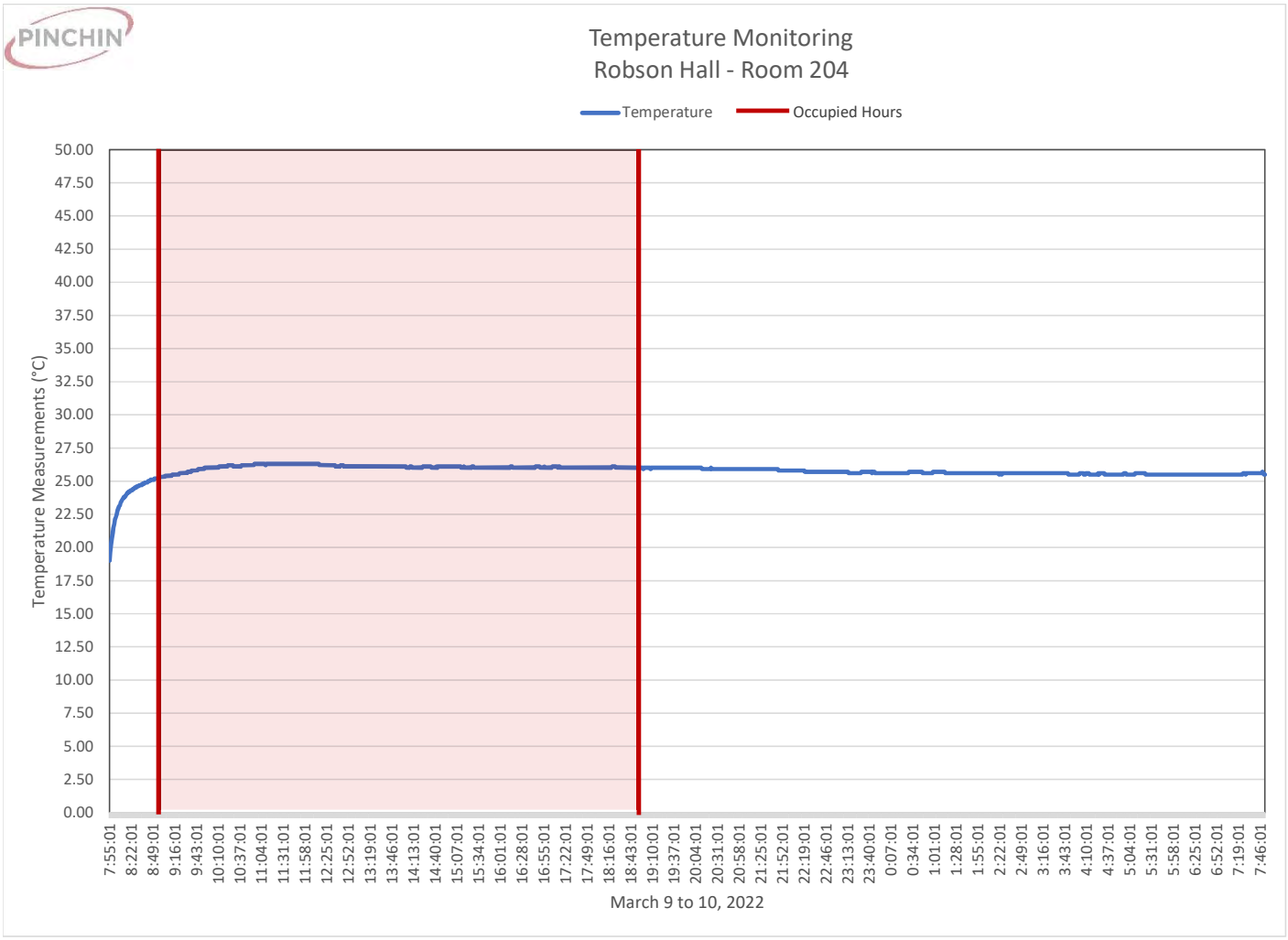
March 9 to 10, 2022


PINCHIN
Temperature Monitoring
Robson Hall - Room 204
Temperature
Occupied Hours
Temperature Measurements (°C)
50.00
47.50
45.00
42.50
40.00
37.50
35.00
32.50
30.00
27.50
25.00
22.50
20.00
17.50
15.00
12.50
10.00
7.50
5.00
2.50
0.00
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11:04:01
11:31:01
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4:10:01
4:37:01
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5:58:01
6:25:01
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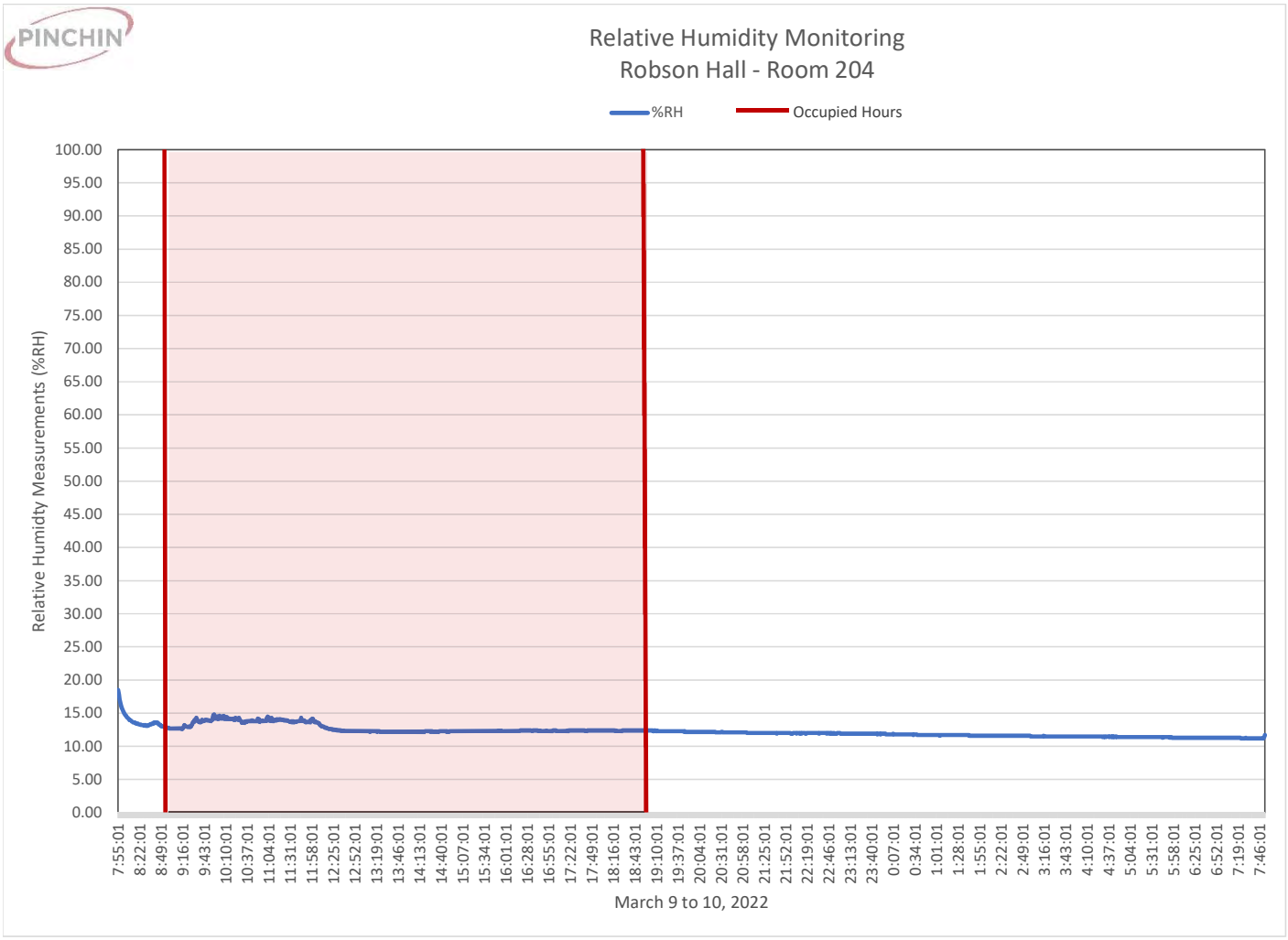
7:46:01
March 9 to 10, 2022


PINCHIN
Relative Humidity Monitoring
Robson Hall - Room 204
%RH
Occupied Hours
Relative Humidty Measurements (%RH)
100.00
95.00
90.00
85.00
80.00
75.00
70.00
65.00
60.00
55.00
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
7:55:01
8:22:01
8:49:01
9:16:01
9:43:01
10:10:01
10:37:01
11:04:01
11:31:01
11:58:01
12:25:01
12:52:01
13:19:01
13:46:01
14:13:01
14:40:01
15:07:01
15:34:01
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4:10:01
4:37:01
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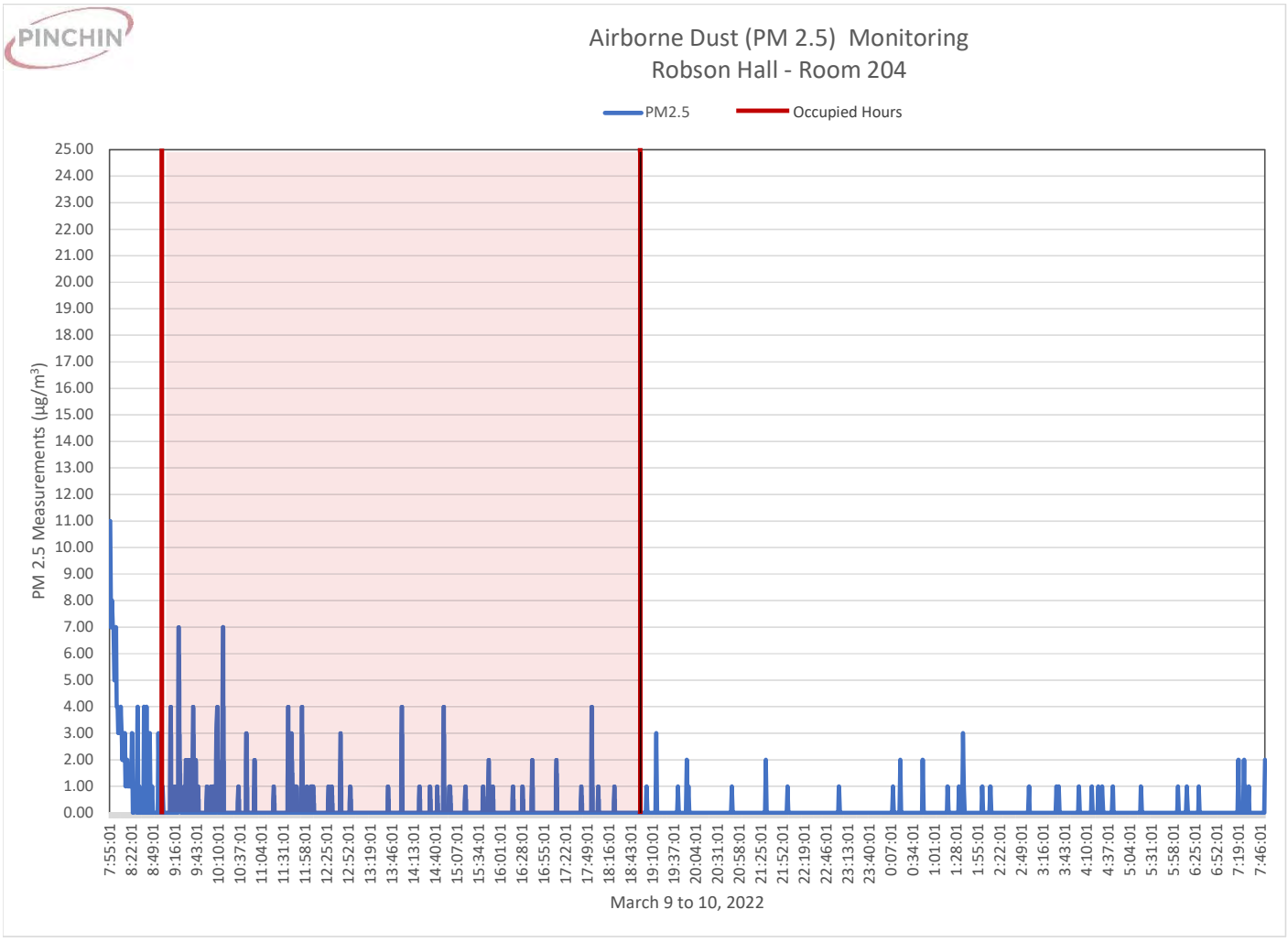
March 9 to 10, 2022


PINCHIN
Airborne Dust (PM 2.5) Monitoring
Robson Hall - Room 204
PM2.5
Occupied Hours
PM 2.5 Measurements (µg/m³)
25.00
24.00
23.00
22.00
21.00
20.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
7:55:01
8:22:01
8:49:01
9:16:01
9:43:01
10:10:01
10:37:01
11:04:01
11:31:01
11:58:01
12:25:01
12:52:01
13:19:01
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15:34:01
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18:16:01
18:43:01
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4:10:01
4:37:01
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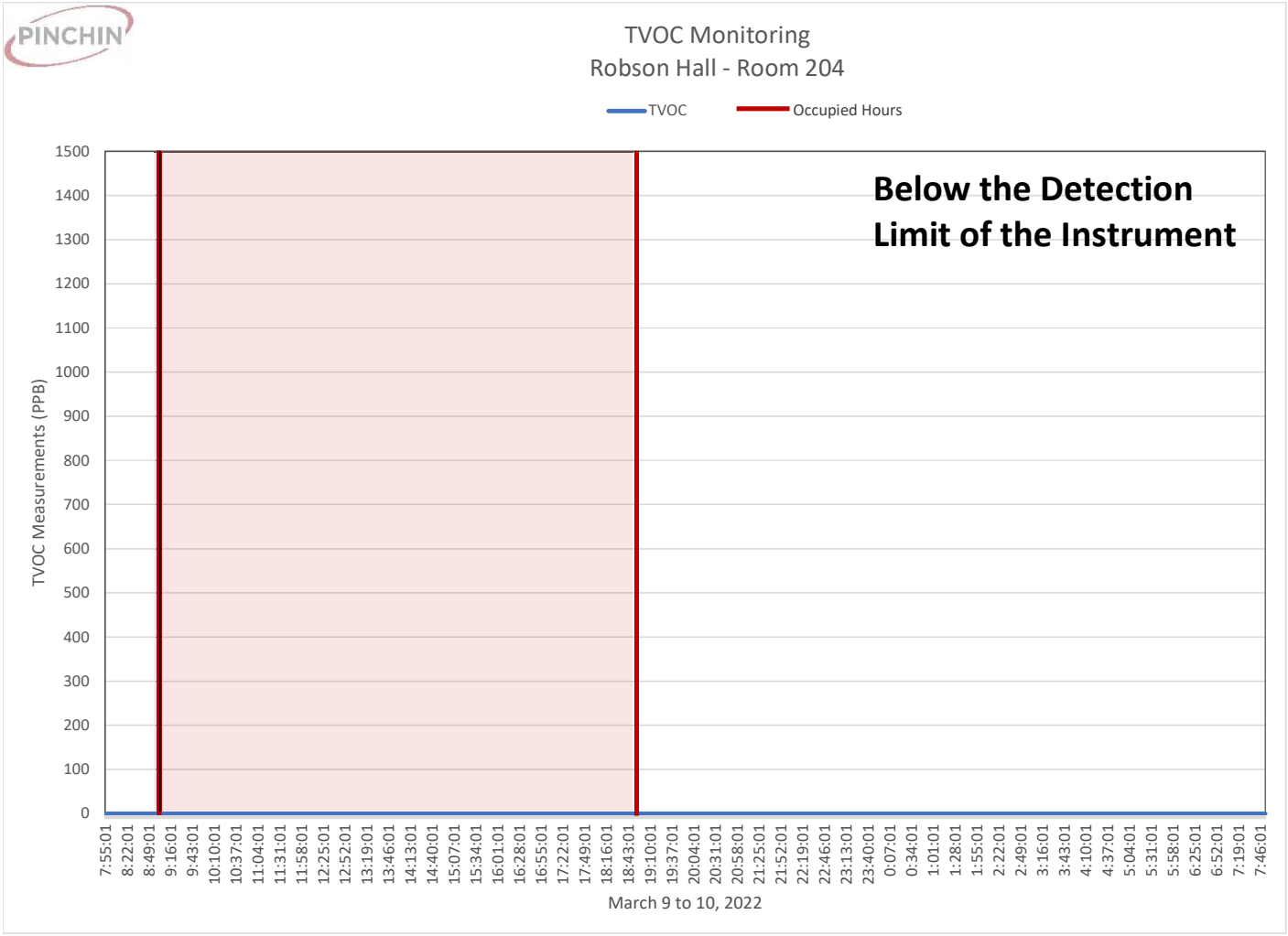
7:19:01
7:46:01
March 9 to 10, 2022


PINCHIN
TVOC Monitoring
Robson Hall - Room 204
TVOC
Occupied Hours
Below the Detection Limit of the Instrument
TVOC Measurements (PPB)
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
7:55:01
8:22:01
8:49:01
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10:37:01
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1:01:01
1:28:01
1:55:01
2:22:01
2:49:01
3:16:01
3:43:01
4:10:01
4:37:01
5:04:01
5:31:01
5:58:01
6:25:01
6:52:01
7:19:01
7:46:01
March 9 to 10, 2022

FINAL

Investigation of Indoor Air Quality

Russell Building
84 Curry Place, Winnipeg, Manitoba

Prepared for:

University of Manitoba
120 Physical Plant, 89 Freedman Crescent
Winnipeg, Manitoba R3T 2N2

April 13, 2022

Pinchin File: 306866

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EXECUTIVE SUMMARY

Pinchin Ltd. (Pinchin) was retained by University of Manitoba (the Client) to conduct an investigation of indoor air quality (IAQ) that included 24-hour monitoring. The work was conducted at 84 Curry Place, Winnipeg, Manitoba. Room 211 of the Russell Building was the data logging location chosen by the client as it was occupied by staff and students during the hours of 09:00 – 11:45, and 13:00 – 17:00. Room 211 is located on the 2nd floor of the Russell Building at the Fort Garry campus. The client also requested that in this location, observations be made specifically to the cleanliness of supply air diffusers and return air grilles.

Along with the 24 hour monitoring in Room 211 the client requested an inspection of the Heating Ventilation Air Conditioning (HVAC) system to determine if there were conditions present that could degrade air quality, i.e., dirty or wrongly fitted filters, presence of moisture, etc..

The majority of the indoor air quality measurements collected were within recommended ranges and meet the criteria of the guidelines referenced. Carbon dioxide concentrations suggested adequate ventilation. Carbon monoxide concentrations did not suggest the presence of exhaust or combustion gases. Temperature measurements were within the recommended comfort ranges for office environments. $PM_{2.5}$ concentrations were within typical ranges. Total Volatile Organic Compound (TVOC) concentrations were within the recommended range. As well the Pinchin inspector did not identify any deficiencies with regards to unusual odours during the investigation.

Relative Humidity measurements were below the recommended comfort range which may result in dry skin, eye and nose irritation. However, it should be noted that low relative humidity is a common wintertime condition in Canada.

Pinchin inspected the Air Handling Unit (AHU) 1and concluded that the AHU was in proper working order with no leaks or standing water build up. AHU 2 was not accessible to inspect. The filters in AHU 1 were clean and free of visible dust and debris.

The following recommendations are offered to improve air quality in this building:

1. Communicate the findings of this report to the staff, and health and safety representitive; and
2. Review the humidification system in the building to ensure it is operational and functioning properly. Consider making adjustments as necessary.

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1.0 INTRODUCTION AND SCOPE

1.1 Statement of Understanding

Pinchin Ltd. (Pinchin) was retained by University of Manitoba (the Client) to conduct an investigation of indoor air quality (IAQ) that included 24-hour monitoring. The work was conducted at 84 Curry Place, Winnipeg, Manitoba. Room 211 of the Russell Building was the data logging location chosen by the client as it was occupied by staff and students during the hours of 09:00 – 11:45, and 13:00 – 17:00. Room 211 is located on the 2nd floor of the Russell Building at the Fort Garry campus. The client also requested that in this location, observations be made specifically to the cleanliness of supply air diffusers and return air grilles. As well as an inspection of the Heating Ventilation Air Conditioning (HVAC) system was requested.

1.2 Scope of Work

Pinchin performed the investigation on March 11, 2022 to March 12, 2022. The scope of this investigation was limited to Room 211. As well as the HVAC system on the 100 Floor Level.

The investigation involved the following activities:

- Review site via in-person walkthrough for factors that could contribute to poor indoor air quality;
- Site review of HVAC equipment servicing the entire building; and
- Data-logging of Carbon Dioxide (CO_2), Carbon Monoxide (CO), Temperature (Temp), Relative Humidity (RH), Total Volatile Organic Compounds (TVOCs) and Particulate Matter smaller than 2.5 micrometres ($PM_{2.5}$) within Room 211.

2.0 METHODOLOGY

2.1 Interviews and Site Reviews

Pinchin interviewed the University of Manitoba Physical Plant, Project and Building Managers to discuss the history of the building, maintenance practices and any indoor air quality concerns.

The investigator did not perform any destructive work to inspect concealed conditions inside wall and/or ceiling cavities.

2.2 Test Methods and Criteria

The following table presents the parameters measured in this investigation, the instruments, the applicable units of measurement, and the Indoor Air Quality criteria used for the evaluation of the results.

Table I – IAQ Parameters Tested, Measurement Criteria and Instruments

Parameter	Unit of Measurement	Recommended Limit	Instrumentation
Carbon dioxide, CO_2	Parts per million in air (ppm)	Outdoor Air (ppm) + 700 ppm [1]	24 hour Data-log Monitoring using a 3M® EVM-7 Air Quality Monitor
Carbon monoxide, CO	ppm	5 ppm [2]	
Temperature, T	°C	21 to 25 °C, winter clothing [3]	
Relative Humidity, RH	%RH	25[4] to 65[5] %, for occupant comfort	
Total Volatile Organic Compounds, (TVOC)	Parts per billion (ppb)	400 ppb[6]	
Particulate Matter smaller than 2.5 micrometres, $PM_{2.5}$	µg/m³	25 µg/m³ [7]24-hour mean;	24 hour Data-log Monitoring using an EVM-7 Air Quality Monitor

All data-logging direct-reading instruments were calibrated before use.

3.0 FINDINGS

3.1 Results of Interviews

Project or Building Manager reported the following:

- Air Handling Units (AHU) filters are changed every three months or as needed;
- The occupant capacity within Room 211 is 60 people; and
- The enrollment/class ranges from 10 to 32 people.

1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Ventilation for Acceptable Indoor Air Quality* [ANSI/ASHRAE Standard 62.1-2019]. Atlanta, GA: ASHRAE, 2019.
2 Health Canada: *Indoor Air Quality in Office Buildings: A Technical Guide*. Ottawa, ON: Health Canada, 1995.
3 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Thermal Environmental Conditions for Human Occupancy* [ANSI/ASHRAE Standard 55-2020]. Atlanta, GA: ASHRAE, 2020.
4 L.E. Burton, J.G. Girman, S.E. Womble: Airborne particulate matter within 100 randomly selected office buildings in the United States (BASE). Proceedings of Healthy Buildings 2000, Vol. 1 (2001).
5 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Thermal Environmental Conditions for Human Occupancy* [ANSI/ASHRAE Standard 55-2020]. Atlanta, GA:ASHRAE, 2020.
6 Value calculated from: US Environmental Protection Agency (EPA) "Building Assessment Survey and Evaluation (BASE) Study [Online] Available at http://www.epa.gov/iaq/base/summarized_data.html#Volatile_Organic_Compounds (Accessed August 25, 2014).
7 W. Team, "WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide : global update 2005 : summary of risk assessment", Apps.who.int, 2021. [Online]. Available: http://apps.who.int/iris/handle/10665/69477. [Accessed: 15-Sep- 2021].

3.2 Facility Description

Table II – Facility Description

Item	Details
Construction Date	1959
Number of Floors	3 Floors above grade, 1 Floor below grade
Structural Type	Steel
Foundation Type	Concrete
Exterior Cladding	Brick
HVAC	Forced air
Roof	Built up
Flooring	Vinyl sheet flooring
Interior Walls	Drywall
Ceilings	Acoustic ceiling tile

3.3 Results of Site Reviews

Appendix I presents the drawings.

There are two Air Handling Units within the Russell Building. AHU-1 provides air to the east side of the building (Photo #1). Inside the AHU there were no leaks or standing water (Photo #2) and the filters fit properly and were observed to be clear (Photo #3). The condensate drain is free from leaks and standing water (Photo #4).

AHU-2 provides air to the west side of the building (Photo #5). Inside the AHU as well as the filters were not accessible so no comment can be made on function or cleanliness.

In the sampling location there were observed to be three supply diffusers (Photo #6) and one return grate (Photo #7). All supply diffusers and return grilles were clean and free from obstructions.

The filters in AHU 1, and 2 are Minimum Efficiency Reporting Value (MERV) of 8 as reported by the client.

Refer to Table III for photographs from the investigation.

Table III – Photographs from Investigation

Photo 1 - AHU- 1

Photo 2 - Inside AHU- 1 free from leaks and standing water

Photo 3 - AHU- 1 filters (clean)

Photo 4 - AHU- 1 and 2 condensates drain free from leaks and standing water

Photo 5 - AHU- 2

Photo 6 - Room 211 supply diffusers

Table III – Photographs from Investigation

Photo 7 - Room 211 return grate

3.4 Results of Indoor Air Quality Tests

Appendix II presents the results of data-logging for IAQ parameters.

The EVM 7 air monitor was used for 24-hour data logging, for just $PM_{2.5}$, CO_2, CO, TVOC, Temperature, and Relative Humidity. The EVM-7 is a direct-reading instrument and were calibrated before use.

3.4.1 Carbon Dioxide (CO_2)

The 24-hour minimum CO_2 concentration recorded within the building was 380 ppm, the maximum CO_2 concentration was 518 ppm. The 24-hour average for CO_2 was 411 ppm. The average CO_2 concentration during **the occupied time** was 428 ppm. On March 11 and March 12 outdoor spot measurements were recorded. The average outdoor CO2 spot measurements for the two days was 409 ppm. The indoor carbon dioxide concentrations were below the limit of 1,128 ppm (428 ppm outdoors plus 700 ppm) recommended by American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE). This indicates that the supply of outdoor air was adequate for the occupancy loading at the time of the investigation.

3.4.2 Carbon Monoxide (CO)

The carbon monoxide concentrations were non-detectable or just at the detection limit of the instrumentation for the duration of the 24-hour monitoring. Health Canada advises that the detection of carbon monoxide above 5 ppm indicates a concern requiring further investigation.

3.4.3 Temperature (Temp)

The 24-hour minimum temperature measurement was 15.5 °C, the maximum temperature measurement was 22.7 °C. The 24-hour average temperature measurement was 20.7 °C. The average temperature measurement during **the occupied time** was 21.7 °C. On March 11 and March 12 outdoor spot measurements were taken each day, averaging -22.0 °C for the two days. The indoor temperatures were within the recommended comfort ranges for commercial environments for typical dress during winter conditions, of 21 to 25 °C.

3.4.4 Relative Humidity (RH)

The 24-hour minimum Relative Humidity measurement was 6.4 %RH, the maximum measurement was 13.1 %RH. The 24-hour average measurement for relative humidity was 6.9 %RH. The average relative humidity measurement during **the occupied time** was 6.9 %RH. On March 11 and March 12 outdoor spot measurements were taken each day, averaging 65 %RH for the two days. Relative humidity below 25 %RH may result in complaints of dry skin and eye and nose irritation. Low relative humidity is a common winter time condition in Canada due to difficulties with humidification.

3.4.5 Particulate Matter ($PM_{2.5}$)

The 24-hour minimum concentration for $PM_{2.5}$ was below the detection limit of the monitoring instrument, the maximum concentration for $PM_{2.5}$ was 15 µg/m³. The 24-hour average concentration for $PM_{2.5}$ was 2 µg/m³. The average $PM_{2.5}$ concentrations during **the occupied time** was 1.38 µg/m³. On March 11 and March 12 outdoor spot measurements were taken each day, averaging 9 µg/m³ for the two days. For reference, World Health Organization (WHO) provides a guideline of 25 µg/m³ over a 24-hour period. The indoor $PM_{2.5}$ concentrations in this building were within the recommended range.

3.4.6 Total Volatile Organic Compounds (TVOC)

The TVOC concentrations were non-detectable or just at the detection limit of the instrumentation for the duration of the 24-hour monitoring. Based on US EPA research, office environments with TVOC concentrations up to 400 ppb would be at little risk of IAQ concern. As this is a guideline, complaints might be expected if concentrations were significantly above 400 ppb.

Table IV – Summary of 24-Hour Data-logging IAQ based on Indoor Air Quality Criteria

Parameter	Measurement Average	Indoor Air Quality Measurement Criteria	Below Indoor Air Quality Measurement Criteria?
Carbon Dioxide	411 ppm	Outdoor Air (ppm) + 700 ppm	Yes
Carbon Monoxide	**Below the Detection Limit of the Monitoring Instrument**	5ppm	Yes
Temperature (°C)	20.7 °C	21 to 25 °C, winter clothing	Yes
Relative Humidity (%)	6.9 %	25 to 65 %, for occupant comfort	No
$PM_{2.5}$	2 µg/m³	25 µg/m³	Yes
TVOC	**Below the Detection Limit of the Monitoring Instrument**	400 ppb	Yes

4.0 DISCUSSION

The majority of the indoor air quality measurements collected were within recommended ranges and meet the criteria of the guidelines referenced. Carbon dioxide concentrations suggested adequate ventilation. Carbon monoxide concentrations did not suggest the presence of exhaust or combustion gases. Temperature measurements were within the recommended comfort ranges for office environments. $PM_{2.5}$ concentrations were within typical ranges. Total Volatile Organic Compound (TVOC) concentrations were within the recommended range. As well the Pinchin inspector did not identify any deficiencies with regards to unusual odours during the investigation.

Relative Humidity measurements were below the recommended comfort range which may result in dry skin, eye and nose irritation. However, it should be noted that low relative humidity is a common wintertime condition in Canada.

Pinchin inspected the Air Handling Unit (AHU) 1and concluded that the AHU was in proper working order with no leaks or standing water build up. AHU 2 was not accessible to inspect. The filters in AHU 1 were clean and free of visible dust and debris.

5.0 RECOMMENDATIONS

Pinchin offers the following recommendations to improve air quality in this building.

1. Communicate the findings of this report to the staff, and health and safety representitive; and
2. Review the humidification system in the building to ensure it is operational and functioning properly. Consider making adjustments as necessary.

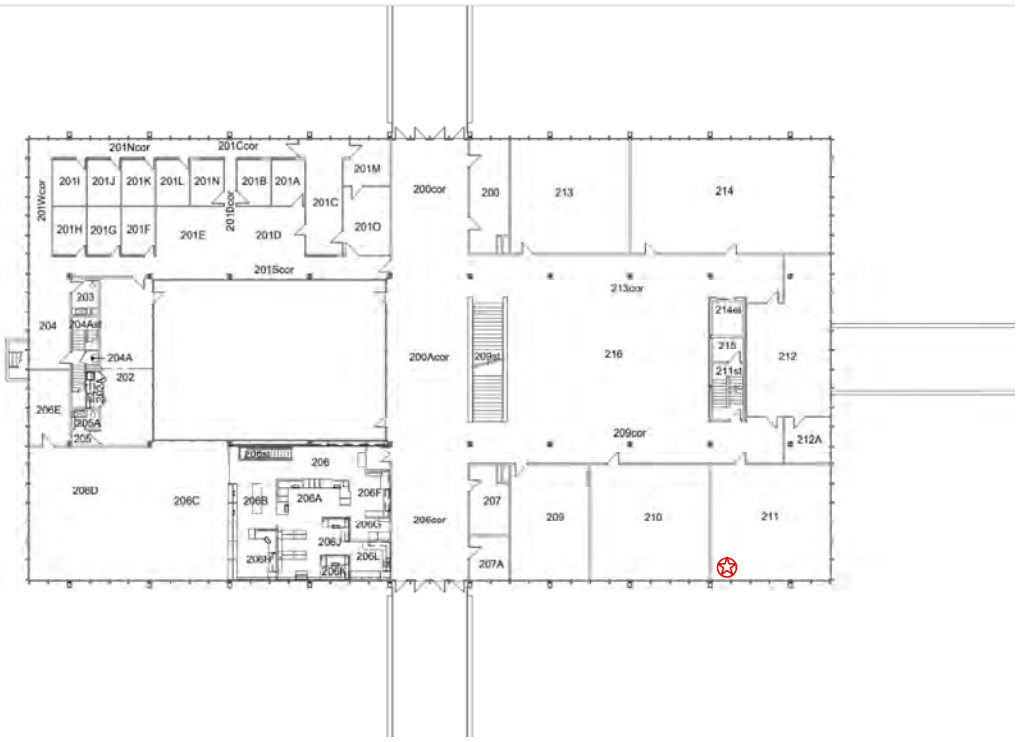
6.0 TERMS AND LIMITATIONS

This work was performed subject to the Terms and Limitations presented or referenced in the proposal for this project.

Information provided by Pinchin is intended for Client use only. Pinchin will not provide results or information to any party unless disclosure by Pinchin is required by law. Any use by a third party of reports or documents authored by Pinchin or any reliance by a third party on or decisions made by a third party based on the findings described in said documents, is the sole responsibility of such third parties. Pinchin accepts no responsibility for damages suffered by any third party as a result of decisions made or actions conducted. No other warranties are implied or expressed.

APPENDIX I

Drawing



N

LEGEND

DATA LOGGING LOCATION

BASE PLAN PROVIDED BY CLIENT.

PINCHIN

PROJECT NAME:
INDOOR AIR QUALITY ASSESSMENT

CLIENT NAME:
UNIVERSITY OF MANITOBA

PROJECT LOCATION:
RUSSELL BUILDING
84 CURRY PLACE
WINNIPEG, MANITOBA

FIGURE NAME:
LEVEL 200

PROJECT NUMBER:	SCALE:
306866	NOT TO SCALE
DRAWN BY:	REVIEWED BY:
CE	JB
DATE:	FIGURE NUMBER:
APRIL 2022	1 OF 1

APPENDIX II

Results of Data-Logging Indoor Air Quality Measurements

Session Report
Russell Building, Room 211
84 Curry Place

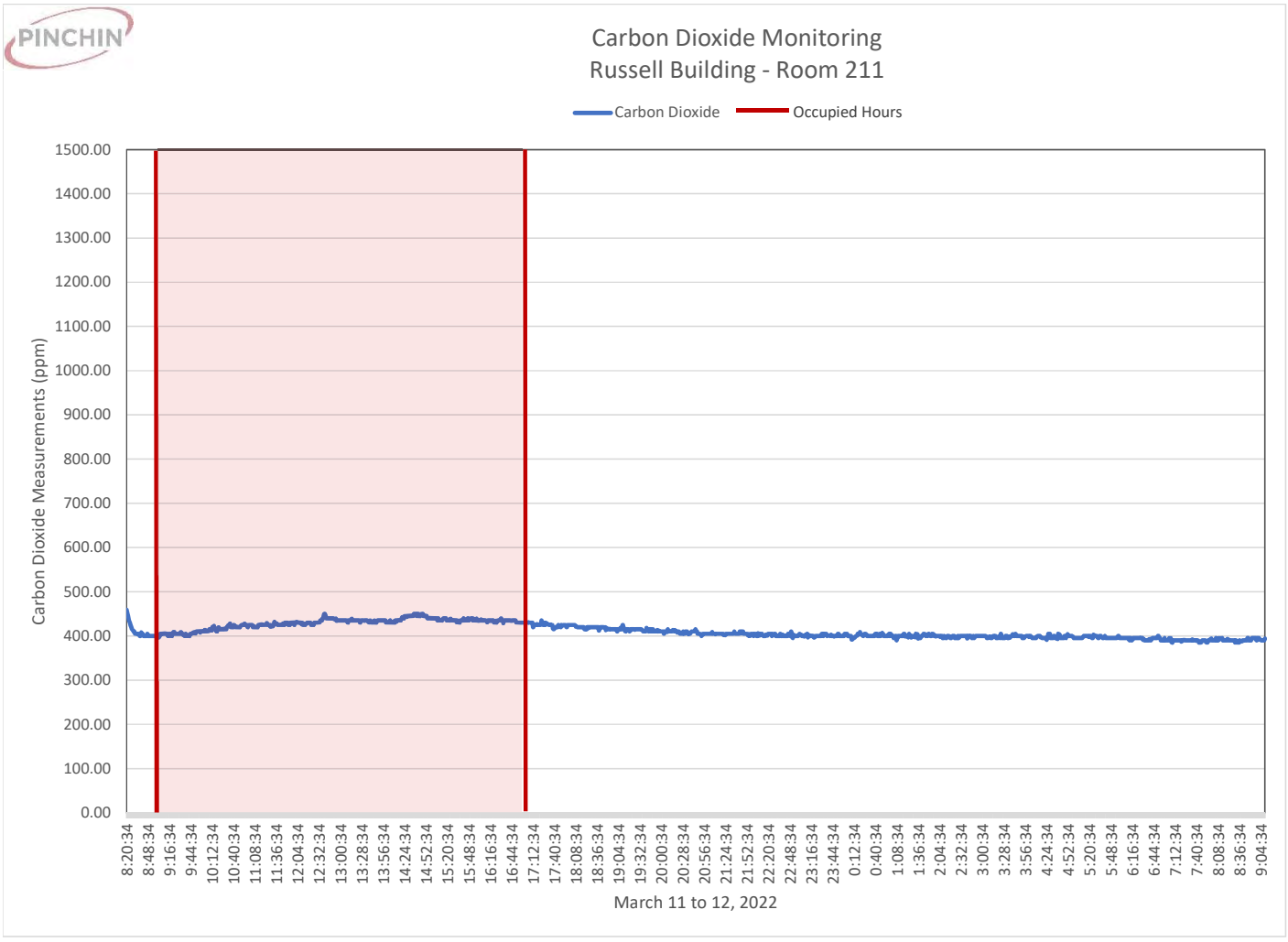
3/12/2022

Datalog Period

Device Name	EMI050016
Serial Number	EMI050016
Run Time	1.00:48:43
Start Time	3/11/2022 8:19:34 AM
Stop Time	3/12/2022 9:08:17 AM

IAQ Data Summary

Description	Value	Description	Value
CO2Ave	411 PPM	CO2Max	518 PPM
CO2MaxTime	3/12/2022 9:10:34 AM	CO2Min	380 PPM
COAve	0 PPM	COMax	0 PPM
COMin	0 PPM	Dust Average	2.000 ug/m³
Dust Max	15.000 ug/m³	Dust Min	0.000 ug/m³
Humidity Avg	6.9 %	Humidity Max	13.1 %
Humidity Max Time	3/11/2022 8:19:32 AM	Humidity Min	6.4 %
Humidity Min Time	3/11/2022 3:49:52 PM	PIDAvePPB	Below the Detection Limit of the Instrument
PIDMaxPPB	Below the Detection Limit of the Instrument	PIDMinPPB	Below the Detection Limit of the Instrument
Temp Avg	20.7 °C	Temp Max Time	3/11/2022 2:17:38 PM
Temp Min Time	3/11/2022 8:19:32 AM	Temperature Max	22.7 °C
Temperature Min	15.5 °C		
Dust Impactor Setting	2.5 µm		


PINCHIN
Carbon Dioxide Monitoring
Russell Building - Room 211
Carbon Dioxide
Occupied Hours
Carbon Dioxide Measurements (ppm)
1500.00
1400.00
1300.00
1200.00
1100.00
1000.00
900.00
800.00
700.00
600.00
500.00
400.00
300.00
200.00
100.00
0.00
8:20:34
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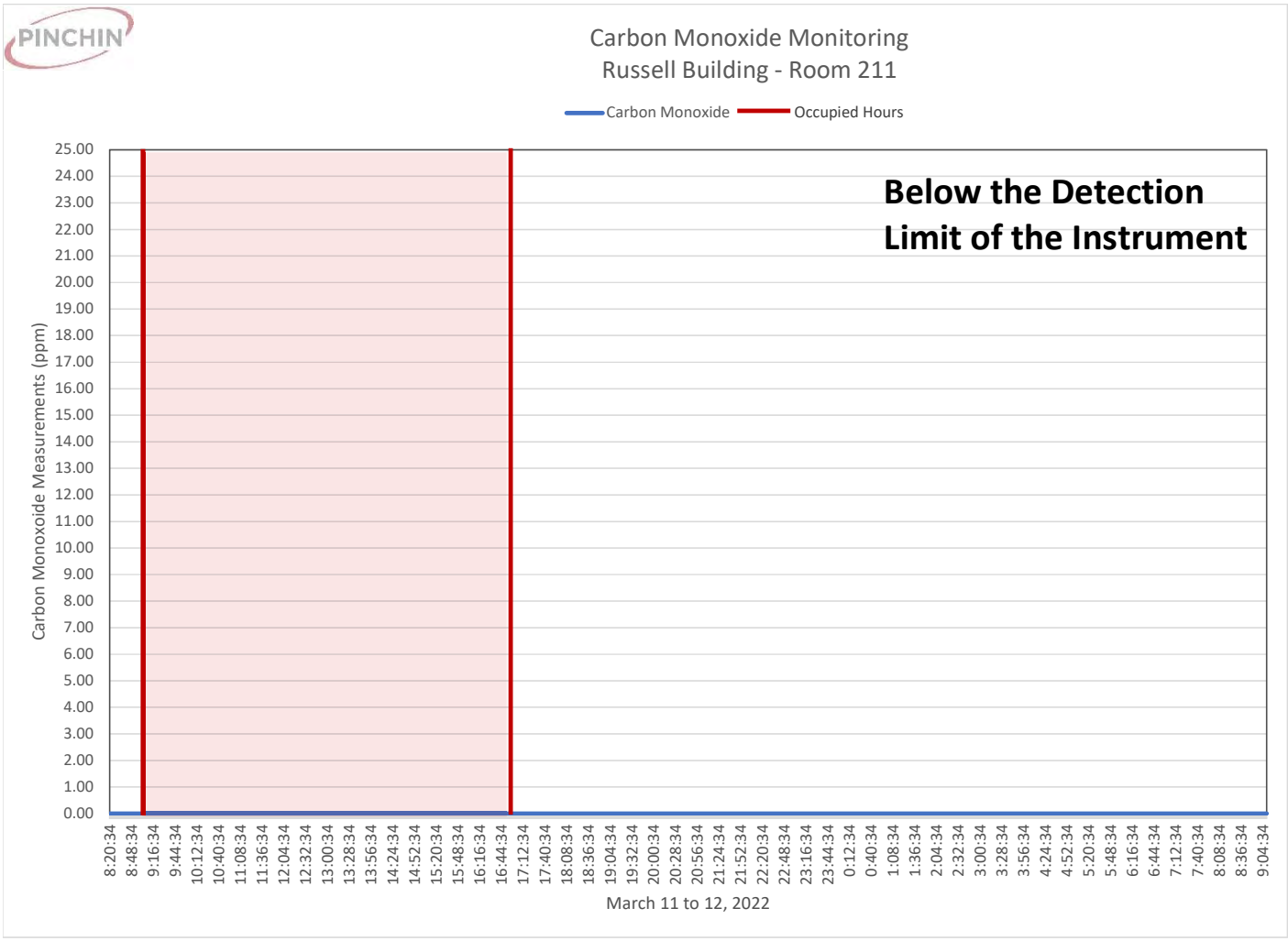
March 11 to 12, 2022


PINCHIN
Carbon Monoxide Monitoring
Russell Building - Room 211
Carbon Monoxide
Occupied Hours
Below the Detection Limit of the Instrument
Carbon Monoxide Measurements (ppm)
25.00
24.00
23.00
22.00
21.00
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14.00
13.00
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23:16:34
23:44:34
0:12:34
0:40:34
1:08:34
1:36:34
2:04:34
2:32:34
3:00:34
3:28:34
3:56:34
4:24:34
4:52:34
5:20:34
5:48:34
6:16:34
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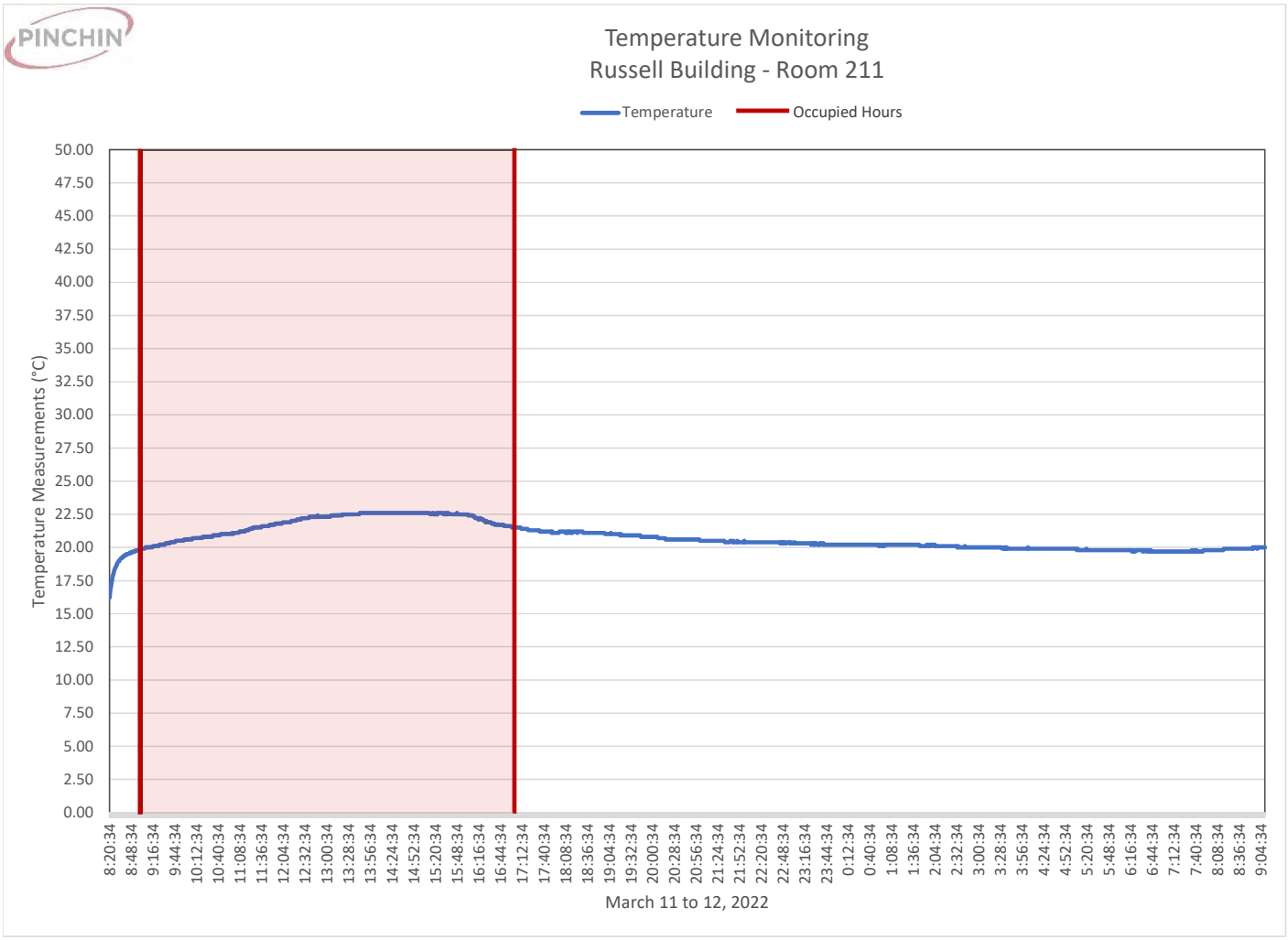
7:12:34
7:40:34
8:08:34
8:36:34
9:04:34
March 11 to 12, 2022


PINCHIN
Temperature Monitoring
Russell Building - Room 211
Temperature
Occupied Hours
Temperature Measurements (°C)
50.00
47.50
45.00
42.50
40.00
37.50
35.00
32.50
30.00
27.50
25.00
22.50
20.00
17.50
15.00
12.50
10.00
7.50
5.00
2.50
0.00
8:20:34
8:48:34
9:16:34
9:44:34
10:12:34
10:40:34
11:08:34
11:36:34
12:04:34
12:32:34
13:00:34
13:28:34
13:56:34
14:24:34
14:52:34
15:20:34
15:48:34
16:16:34
16:44:34
17:12:34
17:40:34
18:08:34
18:36:34
19:04:34
19:32:34
20:00:34
20:28:34
20:56:34
21:24:34
21:52:34
22:20:34
22:48:34
23:16:34
23:44:34
0:12:34
0:40:34
1:08:34
1:36:34
2:04:34
2:32:34
3:00:34
3:28:34
3:56:34
4:24:34
4:52:34
5:20:34
5:48:34
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6:44:34
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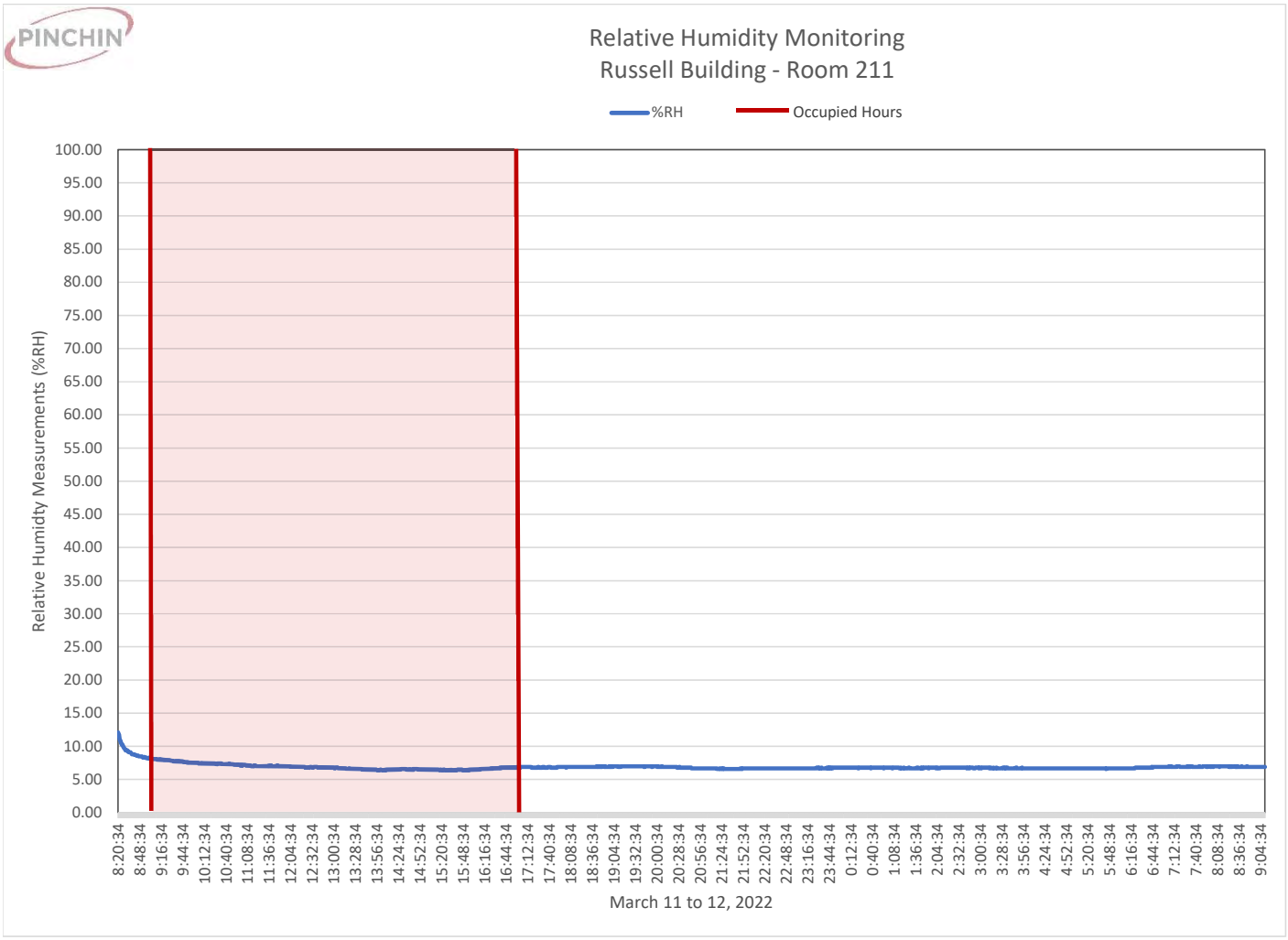
9:04:34
March 11 to 12, 2022


PINCHIN
Relative Humidity Monitoring
Russell Building - Room 211
%RH
Occupied Hours
Relative Humidty Measurements (%RH)
100.00
95.00
90.00
85.00
80.00
75.00
70.00
65.00
60.00
55.00
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
8:20:34
8:48:34
9:16:34
9:44:34
10:12:34
10:40:34
11:08:34
11:36:34
12:04:34
12:32:34
13:00:34
13:28:34
13:56:34
14:24:34
14:52:34
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15:48:34
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17:12:34
17:40:34
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19:32:34
20:00:34
20:28:34
20:56:34
21:24:34
21:52:34
22:20:34
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1:08:34
1:36:34
2:04:34
2:32:34
3:00:34
3:28:34
3:56:34
4:24:34
4:52:34
5:20:34
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7:40:34
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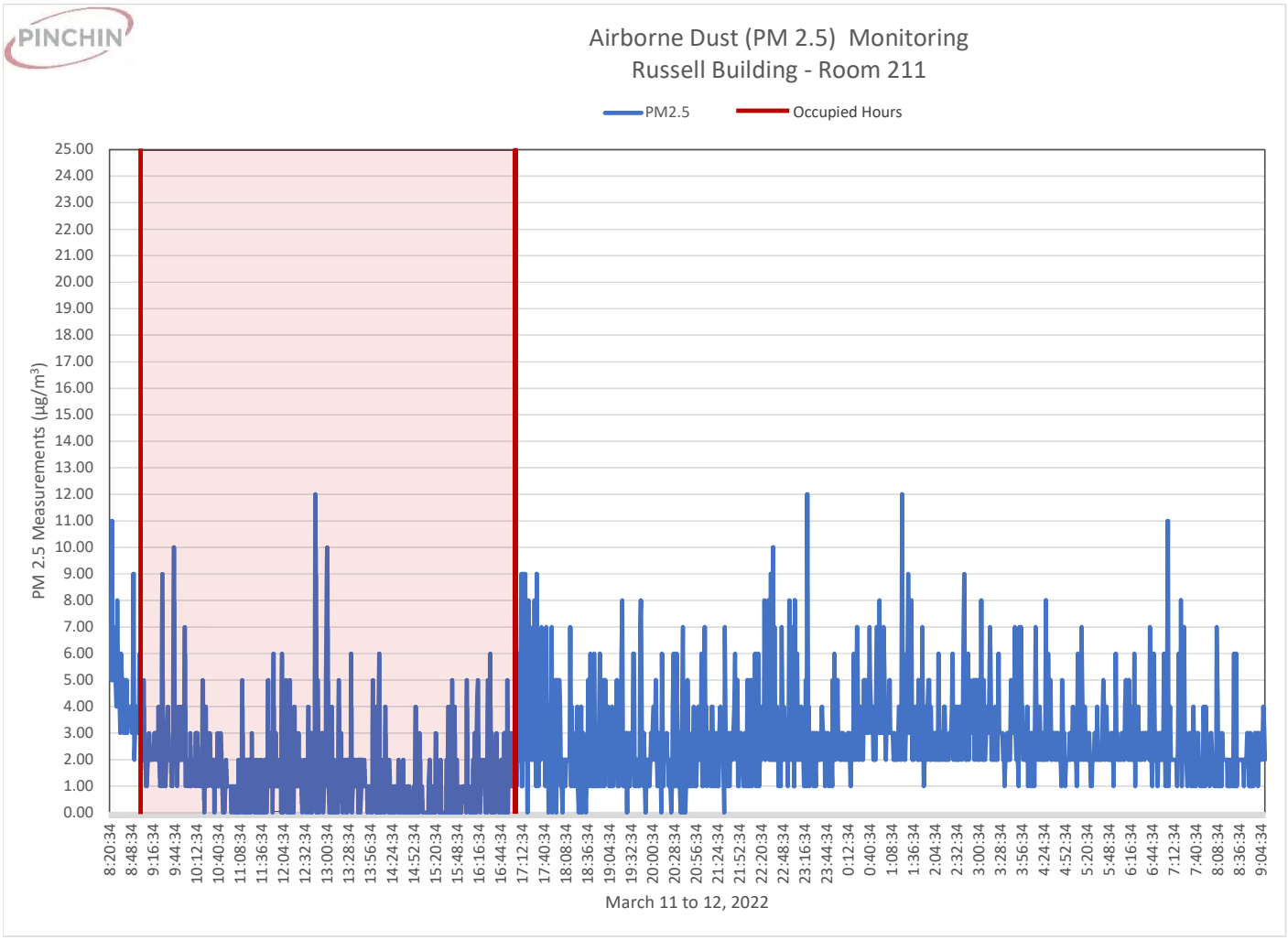
9:04:34
March 11 to 12, 2022


PINCHIN
Airborne Dust (PM 2.5) Monitoring
Russell Building - Room 211
PM2.5
Occupied Hours
PM 2.5 Measurements (µg/m³)
25.00
24.00
23.00
22.00
21.00
20.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
8:20:34
8:48:34
9:16:34
9:44:34
10:12:34
10:40:34
11:08:34
11:36:34
12:04:34
12:32:34
13:00:34
13:28:34
13:56:34
14:24:34
14:52:34
15:20:34
15:48:34
16:16:34
16:44:34
17:12:34
17:40:34
18:08:34
18:36:34
19:04:34
19:32:34
20:00:34
20:28:34
20:56:34
21:24:34
21:52:34
22:20:34
22:48:34
23:16:34
23:44:34
0:12:34
0:40:34
1:08:34
1:36:34
2:04:34
2:32:34
3:00:34
3:28:34
3:56:34
4:24:34
4:52:34
5:20:34
5:48:34
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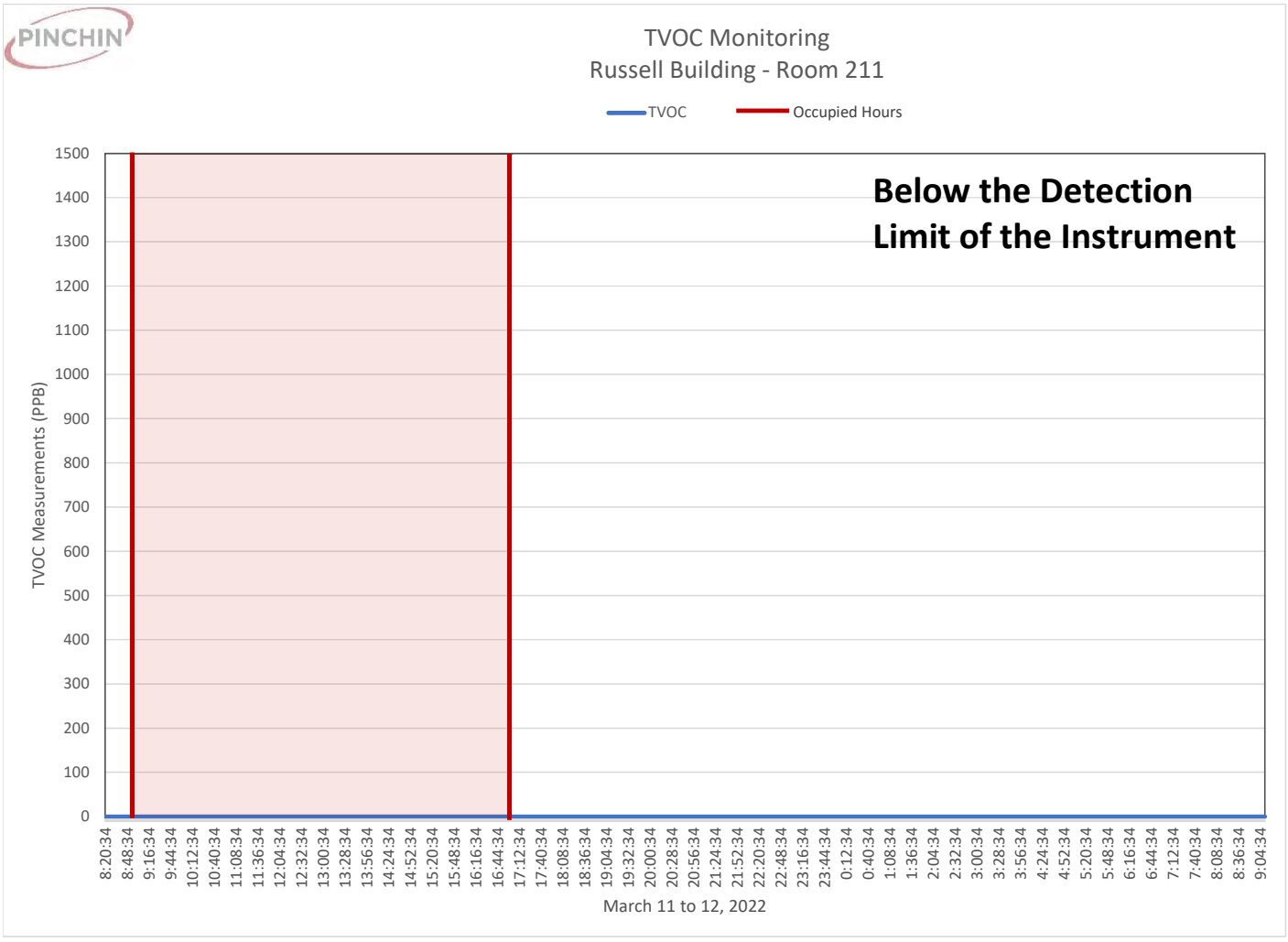
8:36:34
9:04:34
March 11 to 12, 2022


PINCHIN
TVOC Monitoring
Russell Building - Room 211
TVOC
Occupied Hours
Below the Detection Limit of the Instrument
TVOC Measurements (PPB)
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
8:20:34
8:48:34
9:16:34
9:44:34
10:12:34
10:40:34
11:08:34
11:36:34
12:04:34
12:32:34
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21:52:34
22:20:34
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1:08:34
1:36:34
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9:04:34
March 11 to 12, 2022

FINAL

Investigation of Indoor Air Quality

Apotex Building
750 McDermot Avenue, Winnipeg, Manitoba

Prepared for:

University of Manitoba
120 Physical Plant, 89 Freedman Crescent
Winnipeg, Manitoba, R3T 2N2

April 14, 2022

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EXECUTIVE SUMMARY

Pinchin Ltd. (Pinchin) was retained by University of Manitoba (the Client) to conduct an investigation of indoor air quality (IAQ) that included 24-hour monitoring. The work was conducted at 750 McDermot Avenue, Winnipeg, Manitoba. Room 50 and Room 71 of the Apotex Building were the data logging locations chosen by the client as Room 50 was occupied by staff and students during the hours of 9:00 – 10:50 and 11:45 – 13:30, and Room 71 was occupied during the hours of 8:30 – 15:30. Room 50 and Room 71 are located on the Basement Level of the Apotex Centre Building at the Bannatyne campus. The client also requested that in these locations, observations be made specifically to the cleanliness of supply air diffusers and return air grilles.

Along with the 24-hour monitoring in Rooms 50 and 71, the client requested an inspection of the Heating Ventilation Air Conditioning (HVAC) system to determine if there were conditions present that could degrade air quality, i.e., dirty or wrongly fitted filters, presence of moisture, etc.

The majority of the indoor air quality measurements collected were within recommended ranges and meet the criteria of the guidelines referenced. Carbon dioxide concentrations suggested adequate ventilation. Carbon monoxide concentrations did not suggest the presence of exhaust or combustion gases. Temperature measurements were within the recommended comfort ranges for office environments. Particulate Matter ($PM_{2.5}$) concentrations were within typical ranges. Total Volatile Organic Compound (TVOC) concentrations were within the recommended range. As well the Pinchin inspector did not identify any deficiencies with regards to unusual odours during the investigation.

Relative Humidity measurements were below the recommended comfort range which may result in dry skin, eye and nose irritation. However, it should be noted that low relative humidity is a common wintertime condition in Canada.

Pinchin inspected the Air Handling Units (AHUs) and concluded that the AHUs are in proper working order with no leaks or standing water build up. The filters within all AHUs were clean and free of visible dust and debris.

The following recommendations are offered to improve air quality in this building:

1. Communicate the findings of this report to the staff, and health and safety representitive; and
2. Review the humidification system in the building to ensure it is operational and functioning properly. Consider making adjustments as necessary.

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1.0 INTRODUCTION AND SCOPE

1.1 Statement of Understanding

Pinchin Ltd. (Pinchin) was retained by University of Manitoba (the Client) to conduct an investigation of indoor air quality (IAQ) that included 24 hour data-log monitoring. The work was conducted at 750 McDermot Avenue, Winnipeg, Manitoba. Room 50, and Room 71 of the Apotex Building were the data logging locations chosen by the client as Room 50 was occupied by staff and students during the hours of 9:00 – 10:50 and 11:45 – 13:30, and Room 71 was occupied during the hours of 8:30 – 15:30. Room 50 and Room 71 are located on the Basement Level of the Apotex Building at the Bannatyne campus. The client also requested that in these locations, observations be made specifically to the cleanliness of supply air diffusers and return air grilles. As well as an inspection of the Heating Ventilation Air Conditioning (HVAC) system was requested.

1.2 Scope of Work

Pinchin performed the investigation on March 10, 2022 March 12, 2022. The scope of this investigation was limited to Rooms 50 and 71.

The investigation involved the following activities:

- Walkthrough site reviews for factors that could degrade air quality.
- Site review of HVAC equipment servicing the entire building; and
- Data-logging of Carbon Dioxide (CO_2), Carbon Monoxide (CO), Temperature (Temp), Relative Humidity (RH), Total Volatile Organic Compounds (TVOCs) and Particulate Matter smaller than 2.5 micrometres ($PM_{2.5}$) within Rooms 50 and 71.

2.0 METHODOLOGY

2.1 Interviews and Site Reviews

Pinchin interviewed the University of Manitoba Physical Plant, Project and Building Managers to discuss the history of the building, maintenance practices and any indoor air quality concerns.

The investigator did not perform any destructive work to inspect concealed conditions inside wall and/or ceiling cavities.

2.2 Test Methods and Criteria

The following table presents the parameters measured in this investigation, the instruments, the applicable units of measurement, and the Indoor Air Quality criteria used for the evaluation of the results.

Table I – IAQ Parameters Tested, Measurement Criteria and Instruments

Parameter	Unit of Measurement	Recommended Limit	Instrumentation
Carbon dioxide, CO_2	Parts per million in air (ppm)	Outdoor Air (ppm) + 700 ppm [1]	24 hour Data-log Monitoring using a 3M® EVM-7 Air Quality Monitor
Carbon monoxide, CO	ppm	5 ppm [2]	
Temperature, T	°C	21 to 25 °C, winter clothing [3]	
Relative Humidity, RH	%RH	25[4] to 65 %[5], for occupant comfort	
Total Volatile Organic Compounds, (TVOC)	Parts per billion (ppb)	400 ppb[6]	
Particulate Matter smaller than 2.5 micrometres, $PM_{2.5}$	µg/m³	25 µg/m³ 24-hour mean [7];	24 hour Data-log Monitoring using an EVM-7 Air Quality Monitor

All data-logging direct-reading instruments were calibrated before use.

1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Ventilation for Acceptable Indoor Air Quality* [ANSI/ASHRAE Standard 62.1-2019]. Atlanta, GA: ASHRAE, 2019.
2 Health Canada: *Indoor Air Quality in Office Buildings: A Technical Guide*. Ottawa, ON: Health Canada, 1995.
3 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Thermal Environmental Conditions for Human Occupancy* [ANSI/ASHRAE Standard 55-2020]. Atlanta, GA: ASHRAE, 2020.
4 L.E. Burton, J.G. Girman, S.E. Womble: Airborne particulate matter within 100 randomly selected office buildings in the United States (BASE). Proceedings of Healthy Buildings 2000, Vol. 1 (2001).
5 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Thermal Environmental Conditions for Human Occupancy* [ANSI/ASHRAE Standard 55-2020]. Atlanta, GA:ASHRAE, 2020.
6 Value calculated from: US Environmental Protection Agency (EPA) "Building Assessment Survey and Evaluation (BASE) Study [Online] Available at http://www.epa.gov/iaq/base/summarized_data.html#Volatile_Organic_Compounds (Accessed August 25, 2014).
7 W. Team, "WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide : global update 2005 : summary of risk assessment", Apps.who.int, 2021. [Online]. Available: http://apps.who.int/iris/handle/10665/69477. [Accessed: 15-Sep- 2021].

3.0 FINDINGS

3.1 Results of Interviews

Project or Building Manager reported the following:

- Air Handling Units (AHU) filters are changed every three months or as needed; and
- The occupant capacity within Room 50 is 118 people, and for Room 71 is 100 people.

3.2 Facility Description

Table II – Facility Description

Item	Details
Construction Date	1899
Number of Floors	Five floors above grade, one floor below
Structural Type	Steel
Foundation Type	Concrete
Exterior Cladding	Wood siding, glass
HVAC	Forced air
Roof	Built up
Flooring	Vinyl sheet floor
Interior Walls	Drywall, wood panels
Ceilings	Acoustic ceiling tile, drywall, wood panels

3.3 Results of Site Reviews

Appendix I presents the drawings.

There are five Air Handling Units (AHUs) within the Apotex Building. AHU-1 provides air to the 1st floor of the building (Photo #1). Inside the AHU there was no leaks or standing water (Photo #2) and the filters fit properly and were observed to be clear (Photo #3). The condensate drain was free from leaks and standing water (Photo #4).

AHU-2 provides air to the 2nd floor of the building (Photo #5). Inside the AHU there was no leaks or standing water (Photo #6) and the filters fit properly and were observed to be clear (Photo #7). The condensate drain was free from leaks and standing water (Photo #8).

AHU-3 provides air to the 3rd floor of the building (Photo #9). Inside the AHU there was no leaks or standing water (Photo #10) and the filters fit properly and were observed to be clear (Photo #11). The condensate drain was free from leaks and standing water (Photo #12).

AHU-4 provides air to the 4th floor of the building (Photo #13). The filters fit properly and were observed to be clear (Photo #14). The condensate drain was free from leaks and standing water (Photo #15).

AHU-5 provides air to the Basement Level of the building (Photo #16). The filters fit properly and were observed to be clear (Photo #17). The condensate drain was free from leaks and standing water (Photo #18).

In the sampling location Room 50 two supply diffusers were noted (Photo #19) and in location Room 71 ten supply diffusers were noted (Photo #20). Two return grates were noted in Room 71 and Room 50 (Photo #21). All supply diffusers and return grilles were clean and free from obstructions.

The pre filters in all AHUs are Minimum Efficiency Reporting Value (MERV) of 11, the final filters are MERV 14 or better 6"-12" finals on most units. The run time is 24-7 and has a humidification system. The minimum fresh air component is 20-50% based on static pressure.

Refer to Table III for photographs from the investigation.

Table III – Photographs from Investigation

 Photo 1 - AHU-1	 Photo 2 - Inside AHU-1

Table III – Photographs from Investigation

Photo 3 - AHU-1 filters (clean)

Photo 4 - AHU-1 condensate drain free from leaks and standing water

Photo 5 - AHU-2

Photo 6 - Inside AHU-2

Photo 7 - AHU-2 filters (clean)

Photo 8 - AHU-2 condensate drain free from leaks and standing water

Table III – Photographs from Investigation

Photo 9 - AHU-3

Photo 10 - Inside AHU-3

Photo 11 - AHU-3 filters (clean)

Photo 12 - AHU-3 condensate drain free from leaks and standing water

Photo 13 - AHU-4

Photo 14 - AHU-4 filters (clean)

Table III – Photographs from Investigation

Photo 15 - AHU-4 condensate drain free from leaks and standing water

Photo 16 - AHU-5

Photo 17 - AHU-5 filters (clean)

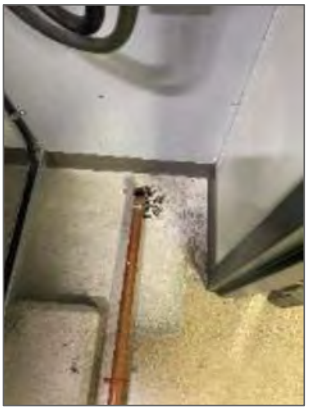


Photo 18 - AHU-5 condensate drain free from leaks and standing water

Photo 19 - Room 50 supply diffuser

Photo 20 - Room 71 supply diffuser

Table III – Photographs from Investigation

Photo 21 - Room 71 return grate

3.4 Results of Indoor Air Quality Tests

Appendix II presents the results of data-logging for IAQ parameters.

The EVM 7 air monitor was used for 24-hour data logging, for just $PM_{2.5}$, CO_2, CO, TVOC, Temperature, and Relative Humidity. The EVM-7 is a direct-reading instrument and were calibrated before use.

3.4.1 Carbon Dioxide (CO_2)

The 24-hour minimum CO_2 concentration recorded within Room 50 was 356 ppm, the maximum CO_2 concentration was 1,011 ppm. The 24-hour average for CO_2 was 431 ppm. The average CO_2 concentration during **the occupied time** was 628 ppm. On March 10 and March 11 outdoor spot measurements were recorded. The average outdoor CO2 spot measurements for the two days was 410 ppm. The indoor carbon dioxide concentrations were below the limit of 1,110 ppm (410 ppm outdoors plus 700 ppm) recommended by American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE). This indicates that the supply of outdoor air was adequate for the occupancy loading at the time of the investigation.

The 24-hour minimum CO_2 concentration recorded within Room 71 was 372 ppm, the maximum CO_2 concentration was 445 ppm. The 24-hour average for CO_2 was 399 ppm. The average CO_2 concentration during **the occupied time** was 406 ppm. On March 11 and March 12 outdoor spot measurements were recorded. The average outdoor CO2 spot measurements for the two days was 409 ppm. The 24-hour average CO2 concentration is 10 ppm lower than the average outdoor concentration. Indoor CO_2 concentrations can be lower than outdoor measurements for a number of reasons; outdoor concentrations to be collected as spot measurements at a very specific finite time. These spot readings can also be influenced by a number of activities at or around the collection site. Examples of these activities could be vehicles driving by or people near the monitoring instrument. When testing for carbon dioxide a 10ppm difference, between any two sample locations, would be considered insignificant. The indoor carbon dioxide concentrations were below the limit of 1,109 ppm (409 ppm outdoors plus 700 ppm) recommended by American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE). This indicates that the supply of outdoor air was adequate for the occupancy loading at the time of the investigation.

3.4.2 Carbon Monoxide (CO)

The carbon monoxide concentrations were non-detectable or just at the detection limit of the instrumentation for the duration of the 24-hour datalogging within Rooms 50, and 71. Health Canada advises that the detection of carbon monoxide above 5 ppm indicates a concern requiring further investigation.

3.4.3 Temperature (Temp)

The 24-hour minimum temperature measurement within Room 50 was 18.3 °C, the maximum temperature measurement was 24.4 °C. The 24-hour average temperature measurement was 23.9 °C. The average temperature measurement during **the occupied time** was 23.7 °C. On March 10 and March 11 outdoor spot measurements were taken each day, averaging -20.5 °C for these dates. The indoor temperatures were within the recommended comfort ranges for office environments for typical dress during winter conditions, of 21 to 25 °C.

The 24-hour minimum temperature measurement within Room 71 was 22.2 °C, the maximum temperature measurement was 24.0 °C. The 24-hour average temperature measurement was 23.1 °C. The average temperature measurement during **the occupied time** was 23.2 °C. On March 11 and March 12 outdoor spot measurements were taken each day, averaging -22.0 °C for these dates. The indoor temperatures were within the recommended comfort ranges for office environments for typical dress during winter conditions, of 21 to 25 °C.

3.4.4 Relative Humidity (RH)

The 24-hour minimum Relative Humidity measurement within Room 50 was 6.1 %RH, the maximum measurement was 12.5 %RH. The 24-hour average measurement for relative humidity was 8.4 %RH. The average relative humidity measurement during **the occupied time** was 8.8 %RH. On March 10 and March 11 outdoor spot measurements were taken each day, averaging 65.0 %RH for these dates.

The 24-hour minimum Relative Humidity measurement was 5.0 %RH, the maximum measurement was 8.2 %RH. The 24-hour average measurement for relative humidity was 5.8 %RH. The average relative humidity measurement during **the occupied time** was 6.0 %RH. On March 11 and March 12 outdoor spot measurements were taken each day, averaging 65.0 %RH for these dates. Relative humidity below 25 %RH may result in complaints of dry skin and eye and nose irritation. Low relative humidity is a common winter time condition in Canada due to difficulties with humidification.

3.4.5 Airborne Dust ($PM_{2.5}$)

The 24-hour minimum concentration within Room 50 for $PM_{2.5}$ was below the detection limit of the monitoring instrument, the maximum concentration for $PM_{2.5}$ was 8 µg/m³. The 24-hour average concentration for $PM_{2.5}$ was 0.13 µg/m³. The average $PM_{2.5}$ concentration during **the occupied time** was 0.46 µg/m³. On March 10 and March 11 outdoor spot measurements were taken each day, averaging 23 µg/m³ for these dates. For reference, World Health Organization (WHO) provides a guideline of 25 µg/m³ over a 24-hour period. The indoor $PM_{2.5}$ concentrations in this building were within the recommended range.

The 24-hour minimum concentration within Room 71 for $PM_{2.5}$ was below the detection limit of the monitoring instrument, the maximum concentration for $PM_{2.5}$ was 4 µg/m³. The 24-hour average concentration for $PM_{2.5}$ was 0.01 µg/m³. The average $PM_{2.5}$ concentration during **the occupied time** was below the detection limit of the monitoring instrument. On March 11 and March 12 outdoor spot measurements were taken each day, averaging 9 µg/m³ for these dates. For reference, World Health Organization (WHO) provides a guideline of 25 µg/m³ over a 24-hour period. The indoor $PM_{2.5}$ concentrations in this building were within the recommended range.

3.4.6 Total Volatile Organic Compounds (TVOC)

The TVOC concentrations were non-detectable or just at the detection limit of the instrumentation for the duration of the 24-hour monitoring within Rooms 50, and 71. Based on US EPA research, office environments with TVOC concentrations up to 400 ppb would be at little risk of IAQ concern. As this is a guideline, complaints might be expected if concentrations were significantly above 400 ppb.

Table IV – Summary of 24-Hour Data-logging IAQ based on Indoor Air Quality Criteria

Parameter	Measurement Average	Indoor Air Quality Measurement Criteria	Below Indoor Air Quality Measurement Criteria?
Carbon Dioxide	Room 50 431 ppm	Outdoor Air (ppm) + 700 ppm	Yes
	Room 71 399 ppm		
Carbon Monoxide	Room 50 **Below the Detection Limit of the Monitoring Instrument**	5ppm	Yes
	Room 71 **Below the Detection Limit of the Monitoring Instrument**		
Temperature (°C)	Room 50 23.0 °C	21 to 25 °C, winter clothing	Yes
	Room 71 23.1 °C		
Relative Humidity (%)	Room 50 8.4 %	25 to 65 %, for occupant comfort	No
	Room 71 5.8 %		
$PM_{2.5}$	Room 50	25 µg/m³	Yes

Table IV – Summary of 24-Hour Data-logging IAQ based on Indoor Air Quality Criteria

	0.13 µg/m³		
	Room 71 0.01 µg/m³		
TVOC	Room 50 **Below the Detection Limit of the Monitoring Instrument**	400 ppb	Yes
	Room 71 **Below the Detection Limit of the Monitoring Instrument**		

4.0 DISCUSSION

The majority of the indoor air quality measurements collected were within recommended ranges and meet the criteria of the guidelines referenced. Carbon dioxide concentrations suggested adequate ventilation. Carbon monoxide concentrations did not suggest the presence of exhaust or combustion gases. Temperature measurements were within the recommended comfort ranges for office environments. $PM_{2.5}$ concentrations were within typical ranges. Total Volatile Organic Compound (TVOC) concentrations were within the recommended range. As well the Pinchin inspector did not identify any deficiencies with regards to unusual odours during the investigation.

Relative Humidity measurements were below the recommended comfort range which may result in dry skin, eye and nose irritation. However, it should be noted that low relative humidity is a common wintertime condition in Canada.

Pinchin inspected the Air Handling Units (AHUs) and concluded that the AHUs are in proper working order with no leaks or standing water build up. The filters within all AHUs were clean and free of visible dust and debris.

5.0 RECOMMENDATIONS

Pinchin offers the following recommendations to improve air quality in this building.

1. Communicate the findings of this report to the staff, and health and safety representitive; and
2. Review the humidification system in the building to ensure it is operational and functioning properly. Consider making adjustments as necessary.

6.0 TERMS AND LIMITATIONS

This work was performed subject to the Terms and Limitations presented or referenced in the proposal for this project.

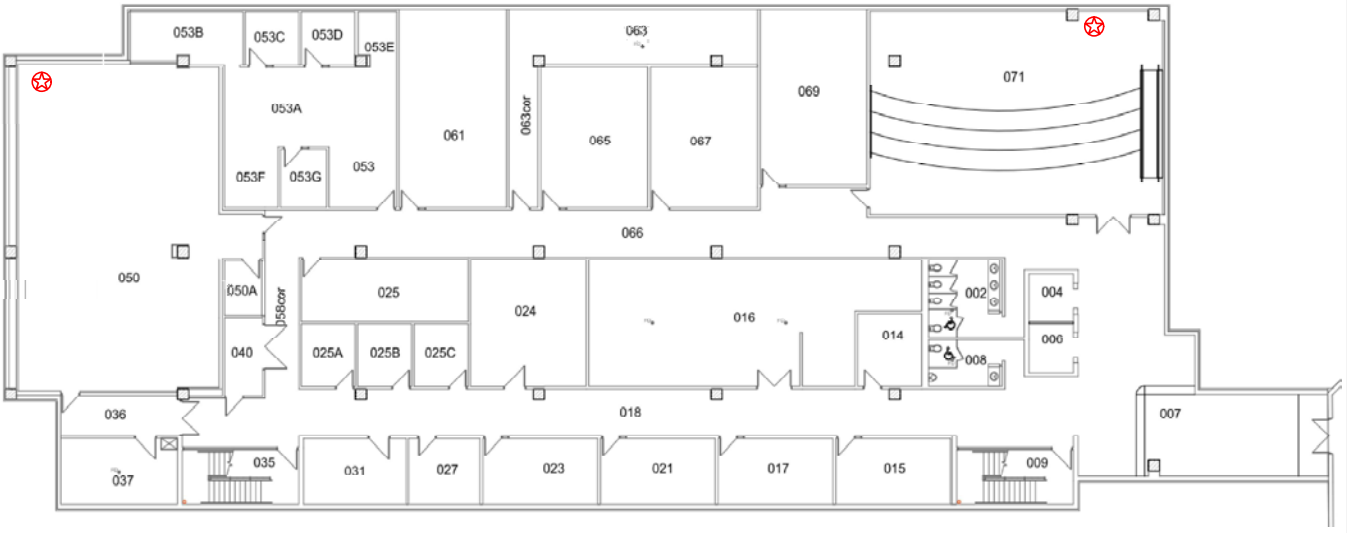
Information provided by Pinchin is intended for Client use only. Pinchin will not provide results or information to any party unless disclosure by Pinchin is required by law. Any use by a third party of reports or documents authored by Pinchin or any reliance by a third party on or decisions made by a third party based on the findings described in said documents, is the sole responsibility of such third parties. Pinchin accepts no responsibility for damages suffered by any third party as a result of decisions made or actions conducted. No other warranties are implied or expressed.

\\pinchin.com\wpg\Job\306000s\0306866.000 UofM,89FREEDMAN,IAQ,ASSMNT\Deliverables\Apotex\306866 Final Report IAQ, Apotex, 750 McDermot ave, Wpg, MB, UofM, April 14, 2022.docx

Template: Master Report Investigation of IAQ, IEQ, September 15, 2021

APPENDIX I

Drawing



N

LEGEND

DATA LOGGING LOCATION

BASE PLAN PROVIDED BY CLIENT.

PINCHIN

PROJECT NAME:
INDOOR AIR QUALITY ASSESSMENT

CLIENT NAME:
UNIVERSITY OF MANITOBA

PROJECT LOCATION:
APOTEX BUILDING
750 MCDERMOT AVENUE
WINNIPEG, MANITOBA

FIGURE NAME:
LEVEL 000

PROJECT NUMBER:	SCALE:
306866	NOT TO SCALE
DRAWN BY:	REVIEWED BY:
CE	JB
DATE:	FIGURE NUMBER:
APRIL 2022	1 OF 1

APPENDIX II

Results of Data-Logging Indoor Air Quality Measurements

Session Report
Apotex Building, Room 50
750 McDermot Avenue

3/11/2022

Datalog Period

Device Name	EMP070003
Serial Number	EMP070003
Run Time	23:15:56
Start Time	3/10/2022 9:02:20 AM
Stop Time	3/11/2022 8:18:16 AM

IAQ Data Summary

Description	Value	Description	Value
CO2Ave	431 PPM	CO2Max	1,011 PPM
CO2MaxTime	3/10/2022 11:00:33 AM	CO2Min	356 PPM
COAve	0 PPM	COMax	0 PPM
COMin	0 PPM	Dust Average	0.13 ug/m³
Dust Max	8.000 ug/m³	Dust Min	0.000 ug/m³
Humidity Avg	8.4 %	Humidity Max	12.5 %
Humidity Max Time	3/10/2022 9:02:44 AM	Humidity Min	6.1 %
Humidity Min Time	3/11/2022 8:20:32 AM	PIDAvePPB	Below the Detection Limit of the Monitoring Instrument
PIDMaxPPB	Below the Detection Limit of the Monitoring Instrument	PIDMinPPB	Below the Detection Limit of the Monitoring Instrument
Temp Avg	23.9 °C	Temp Max Time	3/10/2022 11:49:55 AM
Temp Min Time	3/10/2022 9:02:20 AM	Temperature Max	24.4 °C
Temperature Min	18.3 °C		
Dust Impactor Setting	2.5 µm		

Session Report
Apotex Building, Room 71
750 McDermot Avenue

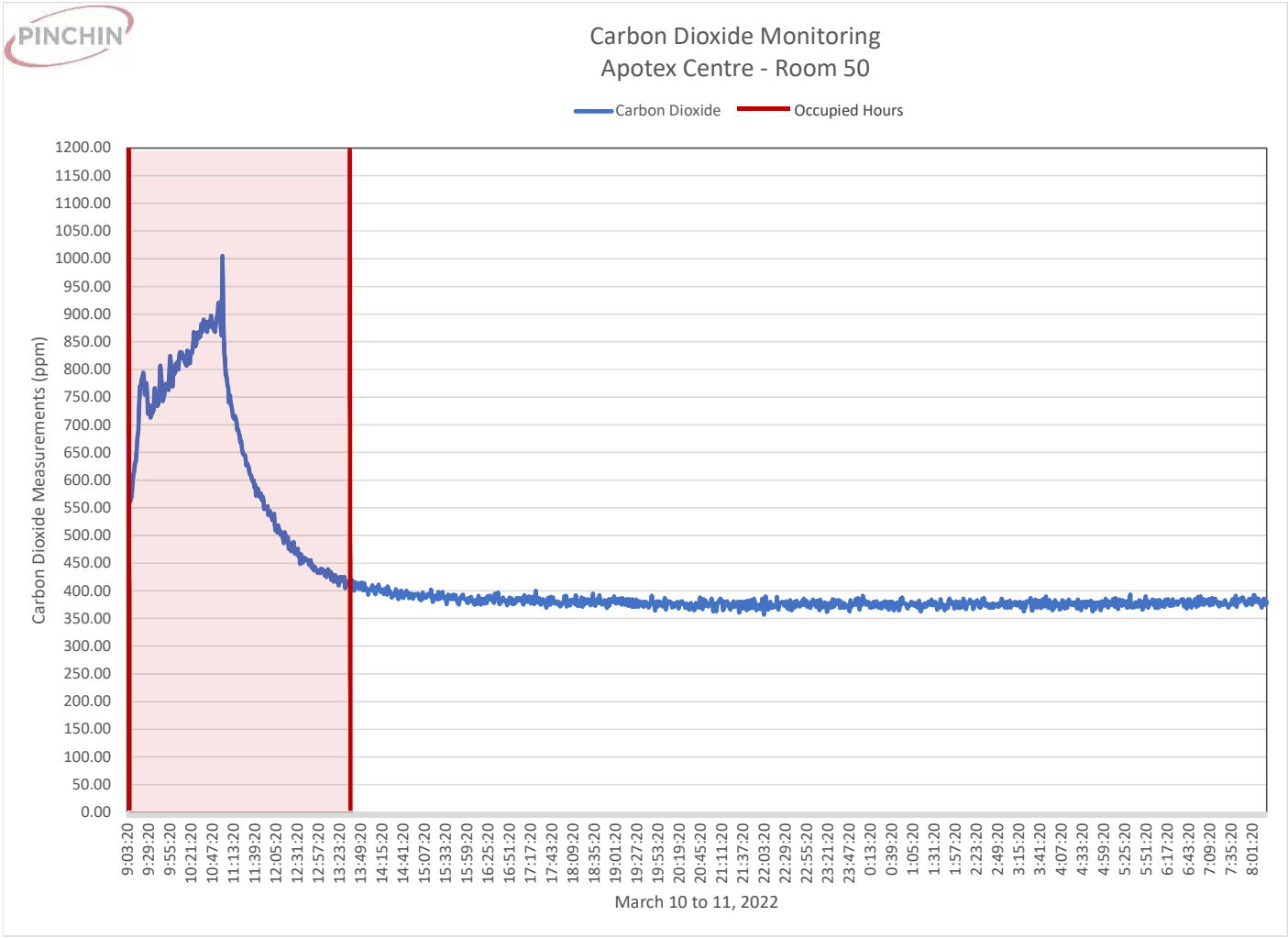
3/12/2022

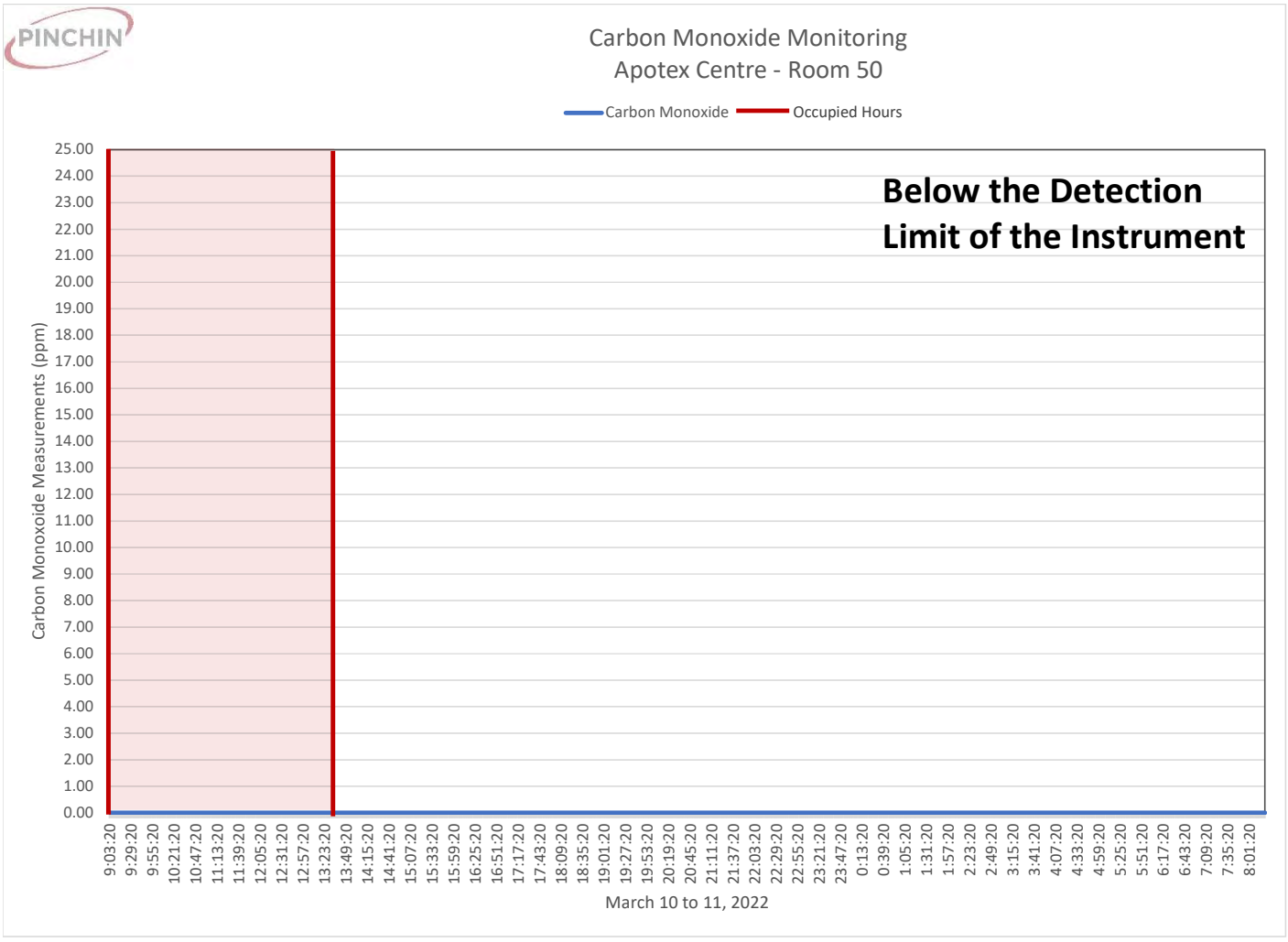
Datalog Period

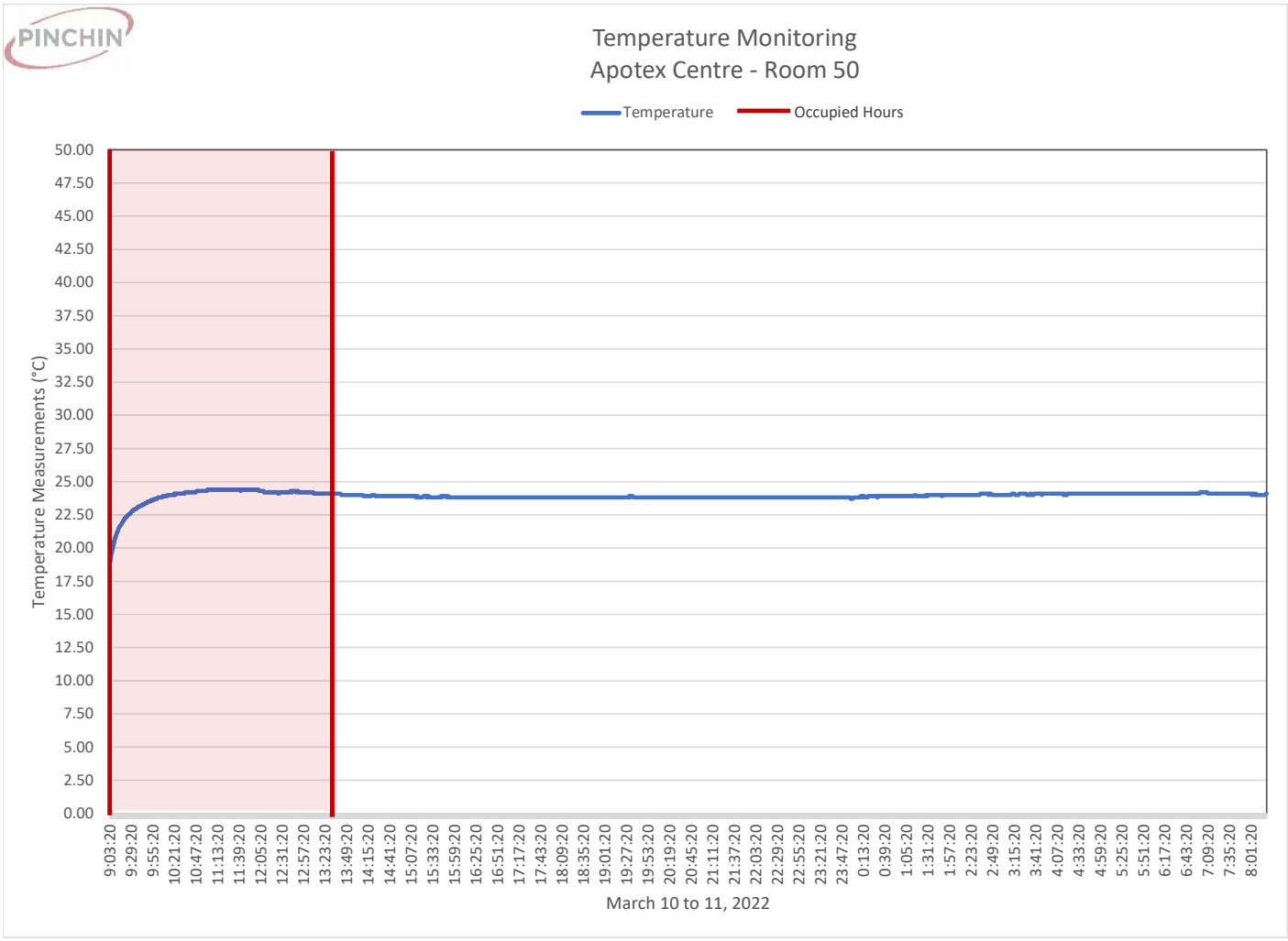
Device Name	EMP070003
Serial Number	EMP070003
Run Time	23:42:09
Start Time	3/11/2022 8:22:30 AM
Stop Time	3/12/2022 8:04:39 AM

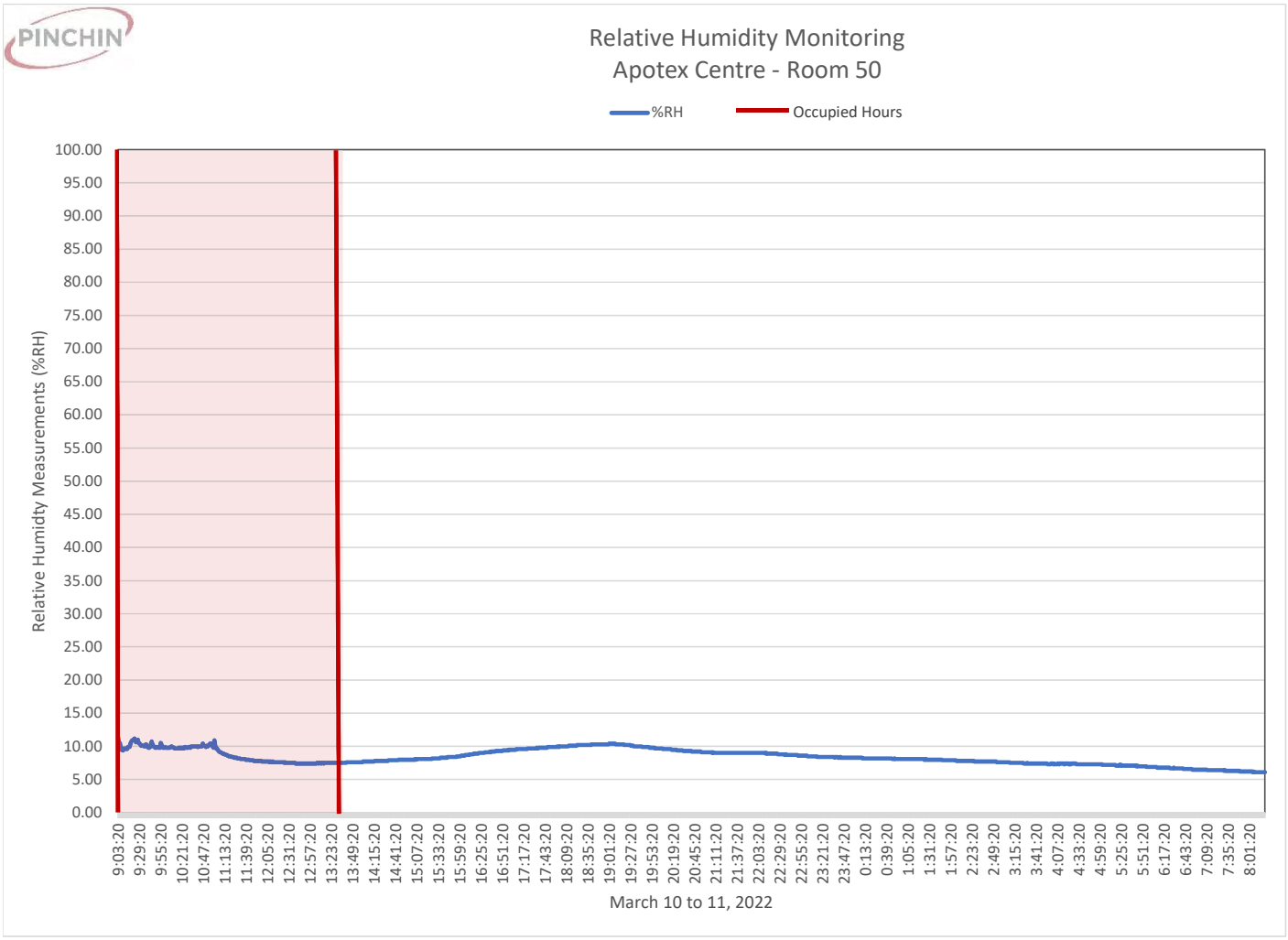
IAQ Data Summary

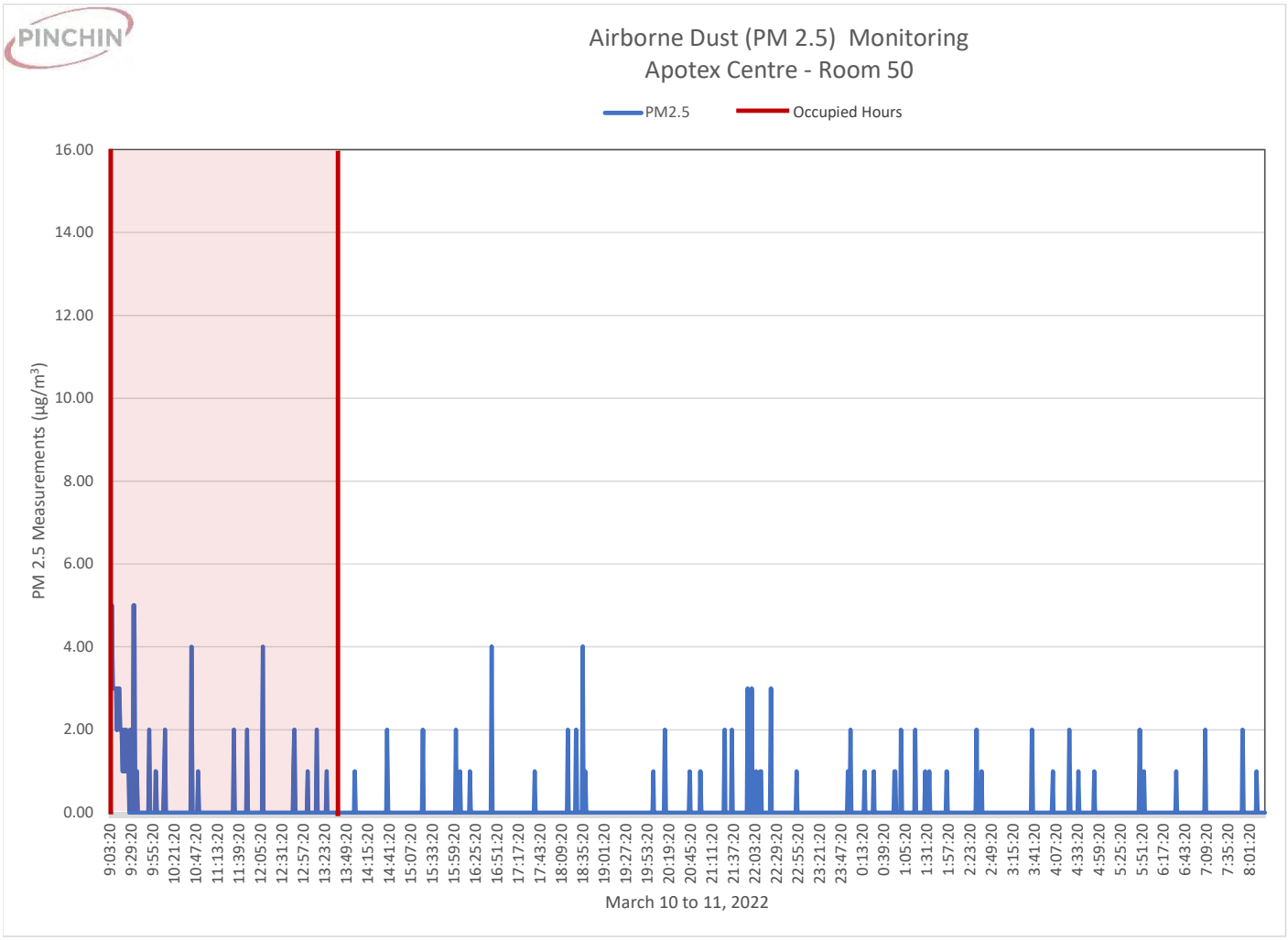
Description	Value	Description	Value
CO2Ave	399 PPM	CO2Max	445 PPM
CO2MaxTime	3/11/2022 8:22:37 AM	CO2Min	372 PPM
COAve	0 PPM	COMax	0 PPM
COMin	0 PPM	Dust Average	0.01 ug/m³
Dust Max	4.000 ug/m³	Dust Min	0.000 ug/m³
Humidity Avg	5.8 %	Humidity Max	8.2 %
Humidity Max Time	3/11/2022 8:22:36 AM	Humidity Min	5.0 %
Humidity Min Time	3/12/2022 7:27:04 AM	PIDAvePPB	Below the Detection Limit of the Monitoring Instrument
PIDMaxPPB	Below the Detection Limit of the Monitoring Instrument	PIDMinPPB	Below the Detection Limit of the Monitoring Instrument
Temp Avg	23.1 °C	Temp Max Time	3/11/2022 9:00:34 AM
Temp Min Time	3/12/2022 6:55:35 AM	Temperature Max	24 °C
Temperature Min	22.2 °C		
Dust Impactor Setting	2.5 µm		

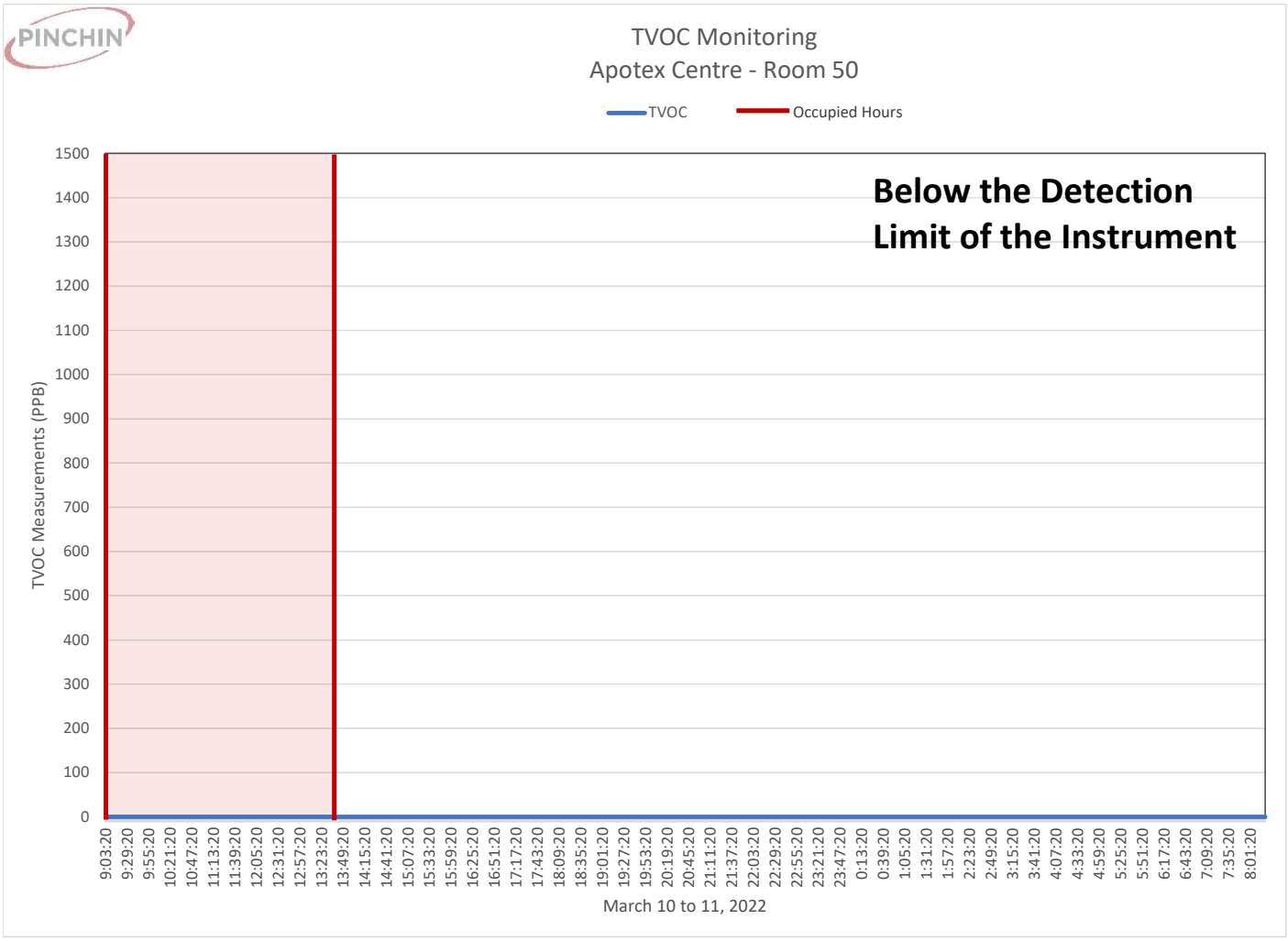

PINCHIN
Carbon Dioxide Monitoring
Apotex Centre - Room 50
Carbon Dioxide
Occupied Hours
Carbon Dioxide Measurements (ppm)
1200.00
1150.00
1100.00
1050.00
1000.00
950.00
900.00
850.00
800.00
750.00
700.00
650.00
600.00
550.00
500.00
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
9:03:20
9:29:20
9:55:20
10:21:20
10:47:20
11:13:20
11:39:20
12:05:20
12:31:20
12:57:20
13:23:20
13:49:20
14:15:20
14:41:20
15:07:20
15:33:20
15:59:20
16:25:20
16:51:20
17:17:20
17:43:20
18:09:20
18:35:20
19:01:20
19:27:20
19:53:20
20:19:20
20:45:20
21:11:20
21:37:20
22:03:20
22:29:20
22:55:20
23:21:20
23:47:20
0:13:20
0:39:20
1:05:20
1:31:20
1:57:20
2:23:20
2:49:20
3:15:20
3:41:20
4:07:20
4:33:20
4:59:20
5:25:20
5:51:20
6:17:20
6:43:20
7:09:20
7:35:20
8:01:20
March 10 to 11, 2022

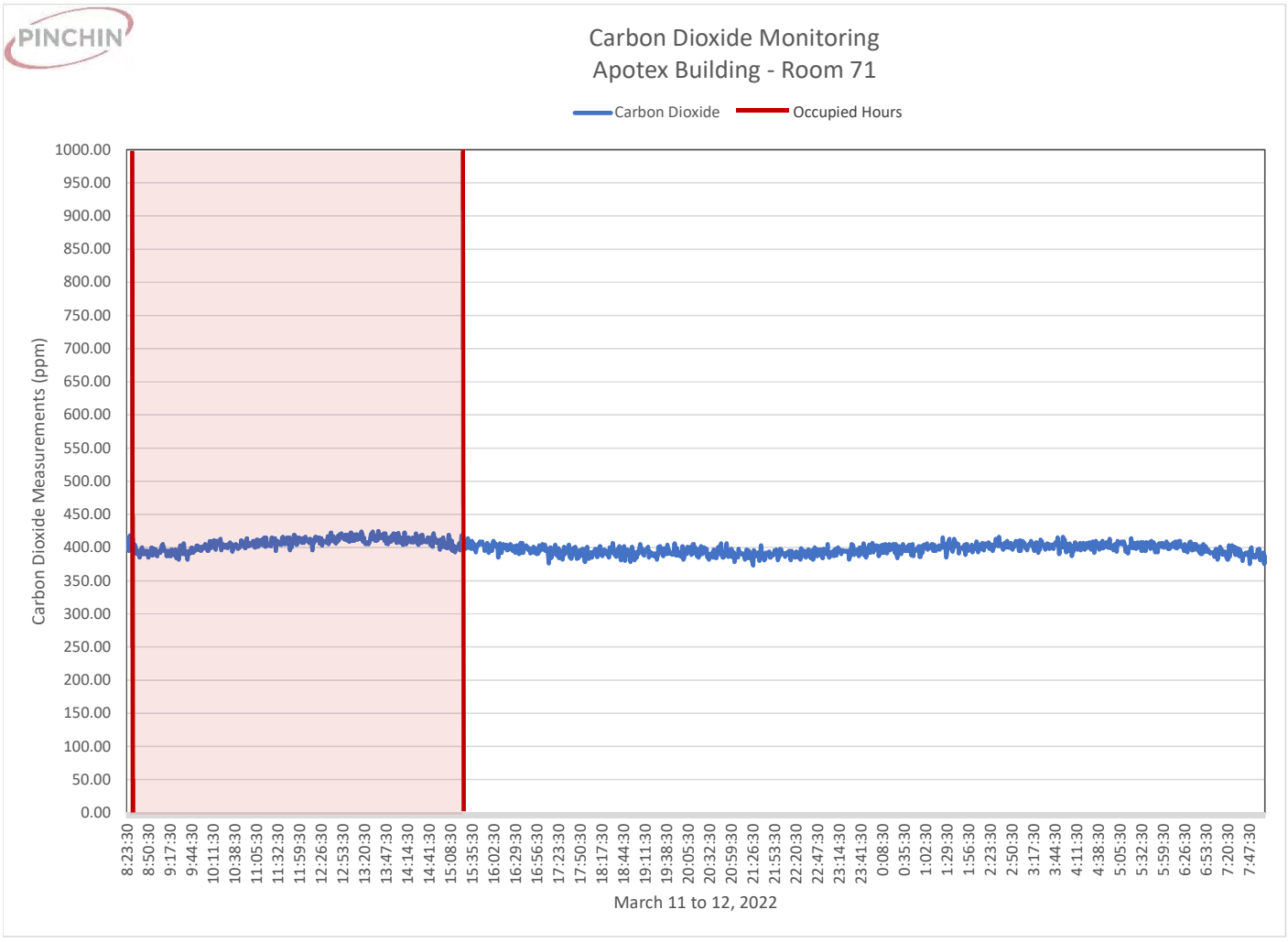

PINCHIN
Carbon Monoxide Monitoring
Apotex Centre - Room 50
Carbon Monoxide
Occupied Hours
Below the Detection Limit of the Instrument
Carbon Monoxide Measurements (ppm)
25.00
24.00
23.00
22.00
21.00
20.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
9:03:20
9:29:20
9:55:20
10:21:20
10:47:20
11:13:20
11:39:20
12:05:20
12:31:20
12:57:20
13:23:20
13:49:20
14:15:20
14:41:20
15:07:20
15:33:20
15:59:20
16:25:20
16:51:20
17:17:20
17:43:20
18:09:20
18:35:20
19:01:20
19:27:20
19:53:20
20:19:20
20:45:20
21:11:20
21:37:20
22:03:20
22:29:20
22:55:20
23:21:20
23:47:20
0:13:20
0:39:20
1:05:20
1:31:20
1:57:20
2:23:20
2:49:20
3:15:20
3:41:20
4:07:20
4:33:20
4:59:20
5:25:20
5:51:20
6:17:20
6:43:20
7:09:20
7:35:20
8:01:20
March 10 to 11, 2022

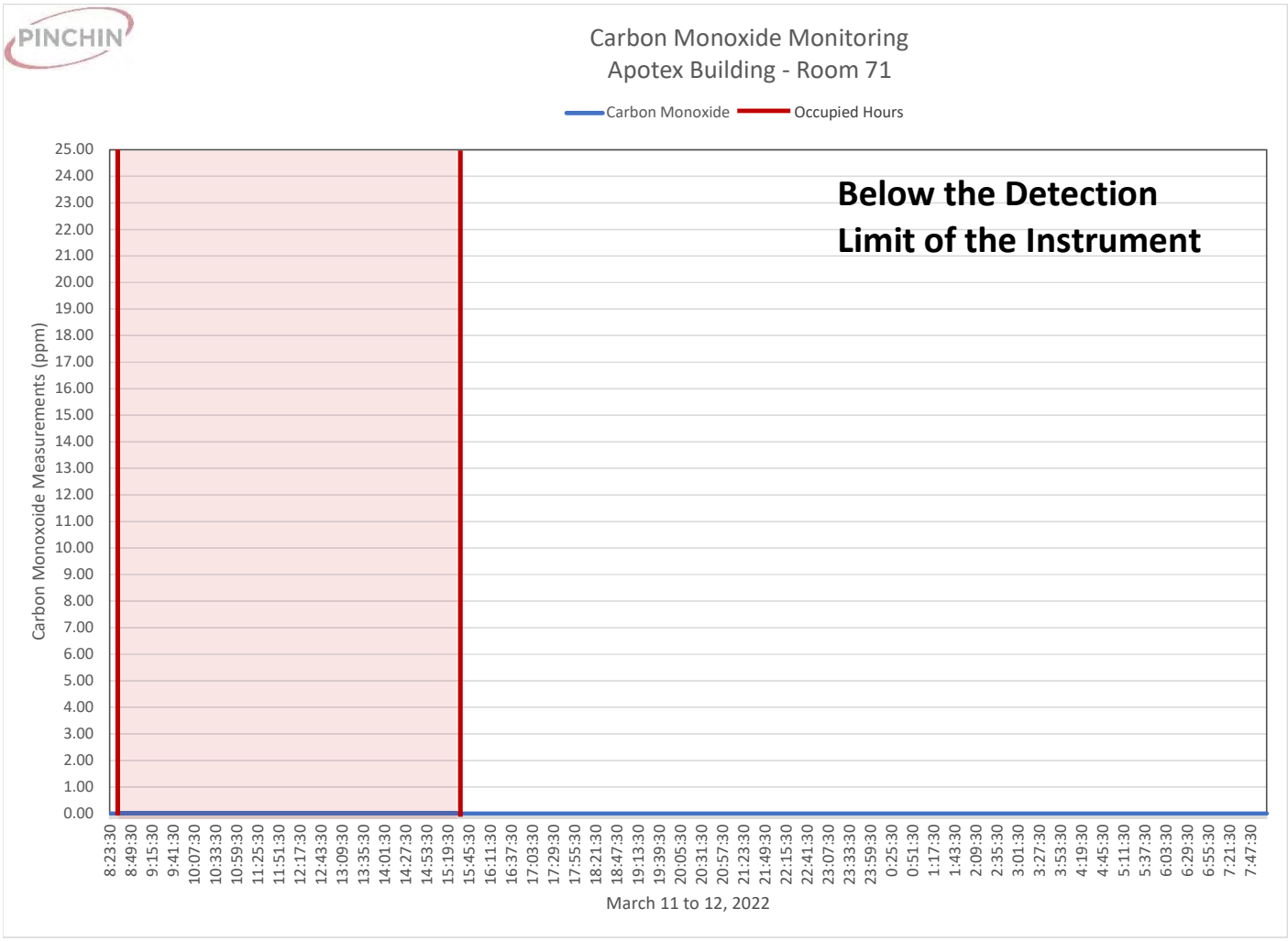

PINCHIN
Temperature Monitoring
Apotex Centre - Room 50
Temperature
Occupied Hours
Temperature Measurements (°C)
50.00
47.50
45.00
42.50
40.00
37.50
35.00
32.50
30.00
27.50
25.00
22.50
20.00
17.50
15.00
12.50
10.00
7.50
5.00
2.50
0.00
9:03:20
9:29:20
9:55:20
10:21:20
10:47:20
11:13:20
11:39:20
12:05:20
12:31:20
12:57:20
13:23:20
13:49:20
14:15:20
14:41:20
15:07:20
15:33:20
15:59:20
16:25:20
16:51:20
17:17:20
17:43:20
18:09:20
18:35:20
19:01:20
19:27:20
19:53:20
20:19:20
20:45:20
21:11:20
21:37:20
22:03:20
22:29:20
22:55:20
23:21:20
23:47:20
0:13:20
0:39:20
1:05:20
1:31:20
1:57:20
2:23:20
2:49:20
3:15:20
3:41:20
4:07:20
4:33:20
4:59:20
5:25:20
5:51:20
6:17:20
6:43:20
7:09:20
7:35:20
8:01:20
March 10 to 11, 2022

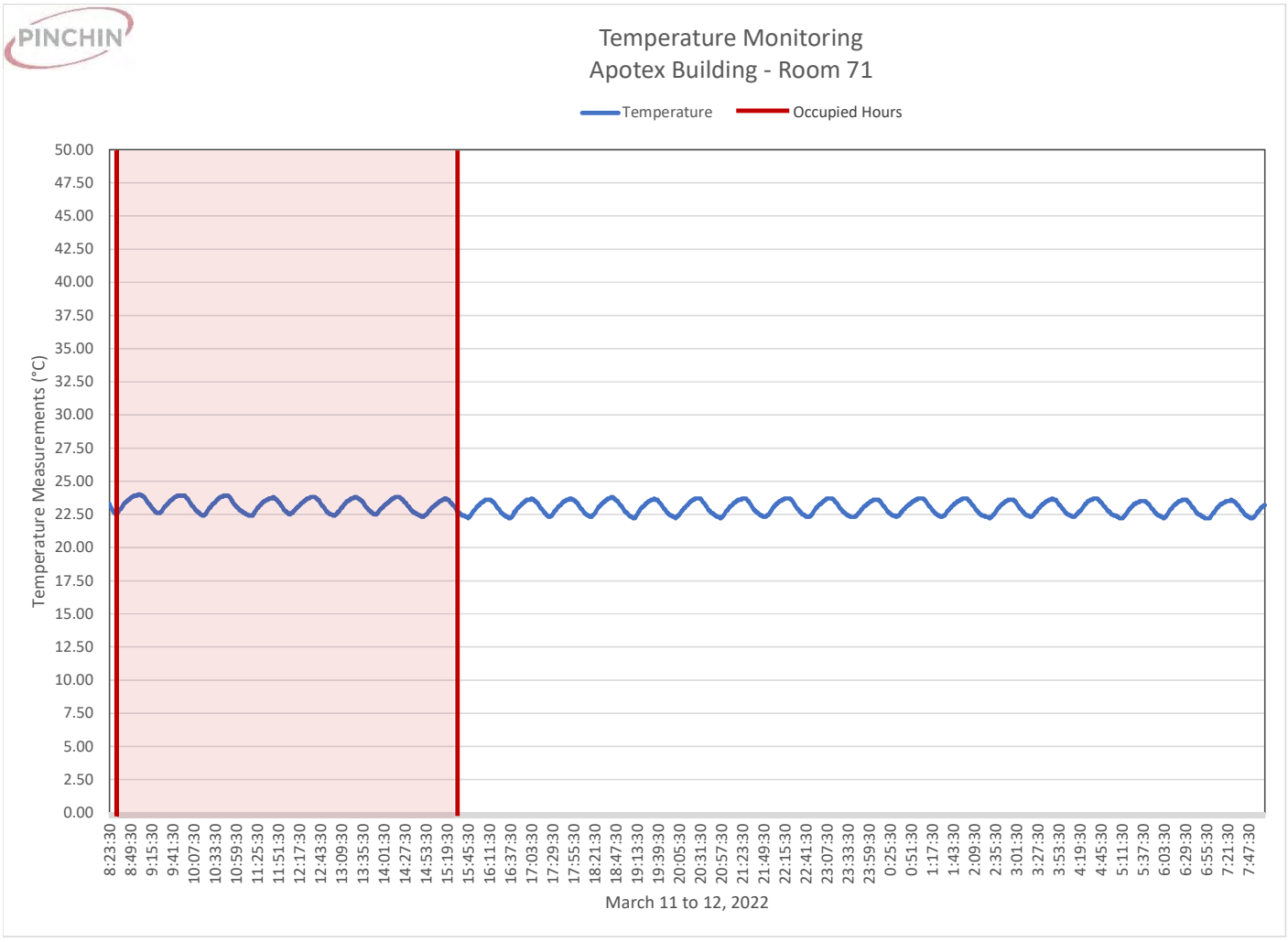

PINCHIN
Relative Humidity Monitoring
Apotex Centre - Room 50
%RH
Occupied Hours
Relative Humidty Measurements (%RH)
100.00
95.00
90.00
85.00
80.00
75.00
70.00
65.00
60.00
55.00
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
9:03:20
9:29:20
9:55:20
10:21:20
10:47:20
11:13:20
11:39:20
12:05:20
12:31:20
12:57:20
13:23:20
13:49:20
14:15:20
14:41:20
15:07:20
15:33:20
15:59:20
16:25:20
16:51:20
17:17:20
17:43:20
18:09:20
18:35:20
19:01:20
19:27:20
19:53:20
20:19:20
20:45:20
21:11:20
21:37:20
22:03:20
22:29:20
22:55:20
23:21:20
23:47:20
0:13:20
0:39:20
1:05:20
1:31:20
1:57:20
2:23:20
2:49:20
3:15:20
3:41:20
4:07:20
4:33:20
4:59:20
5:25:20
5:51:20
6:17:20
6:43:20
7:09:20
7:35:20
8:01:20
March 10 to 11, 2022

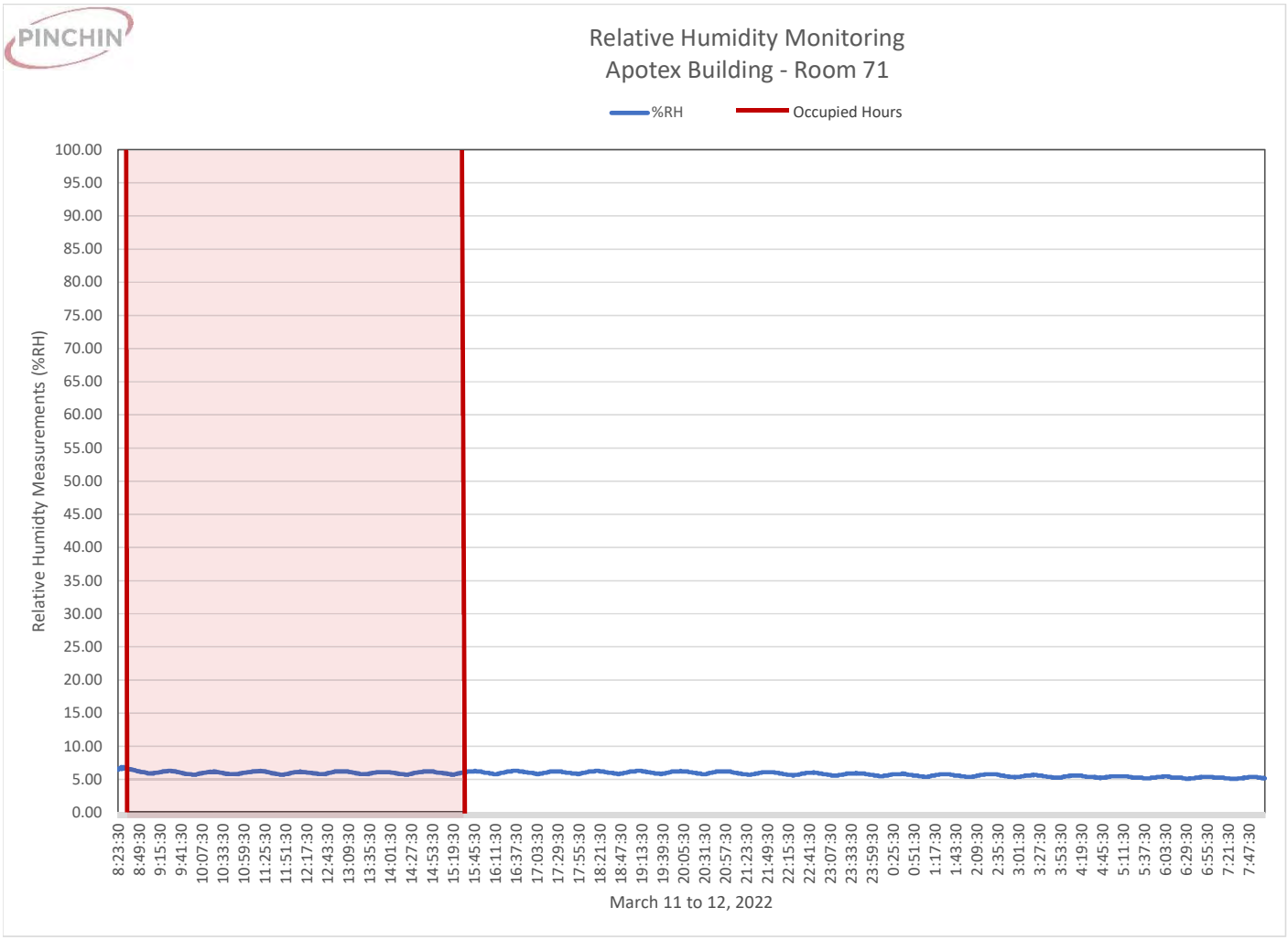

PINCHIN
Airborne Dust (PM 2.5) Monitoring
Apotex Centre - Room 50
PM2.5
Occupied Hours
PM 2.5 Measurements (µg/m³)
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
9:03:20
9:29:20
9:55:20
10:21:20
10:47:20
11:13:20
11:39:20
12:05:20
12:31:20
12:57:20
13:23:20
13:49:20
14:15:20
14:41:20
15:07:20
15:33:20
15:59:20
16:25:20
16:51:20
17:17:20
17:43:20
18:09:20
18:35:20
19:01:20
19:27:20
19:53:20
20:19:20
20:45:20
21:11:20
21:37:20
22:03:20
22:29:20
22:55:20
23:21:20
23:47:20
0:13:20
0:39:20
1:05:20
1:31:20
1:57:20
2:23:20
2:49:20
3:15:20
3:41:20
4:07:20
4:33:20
4:59:20
5:25:20
5:51:20
6:17:20
6:43:20
7:09:20
7:35:20
8:01:20
March 10 to 11, 2022

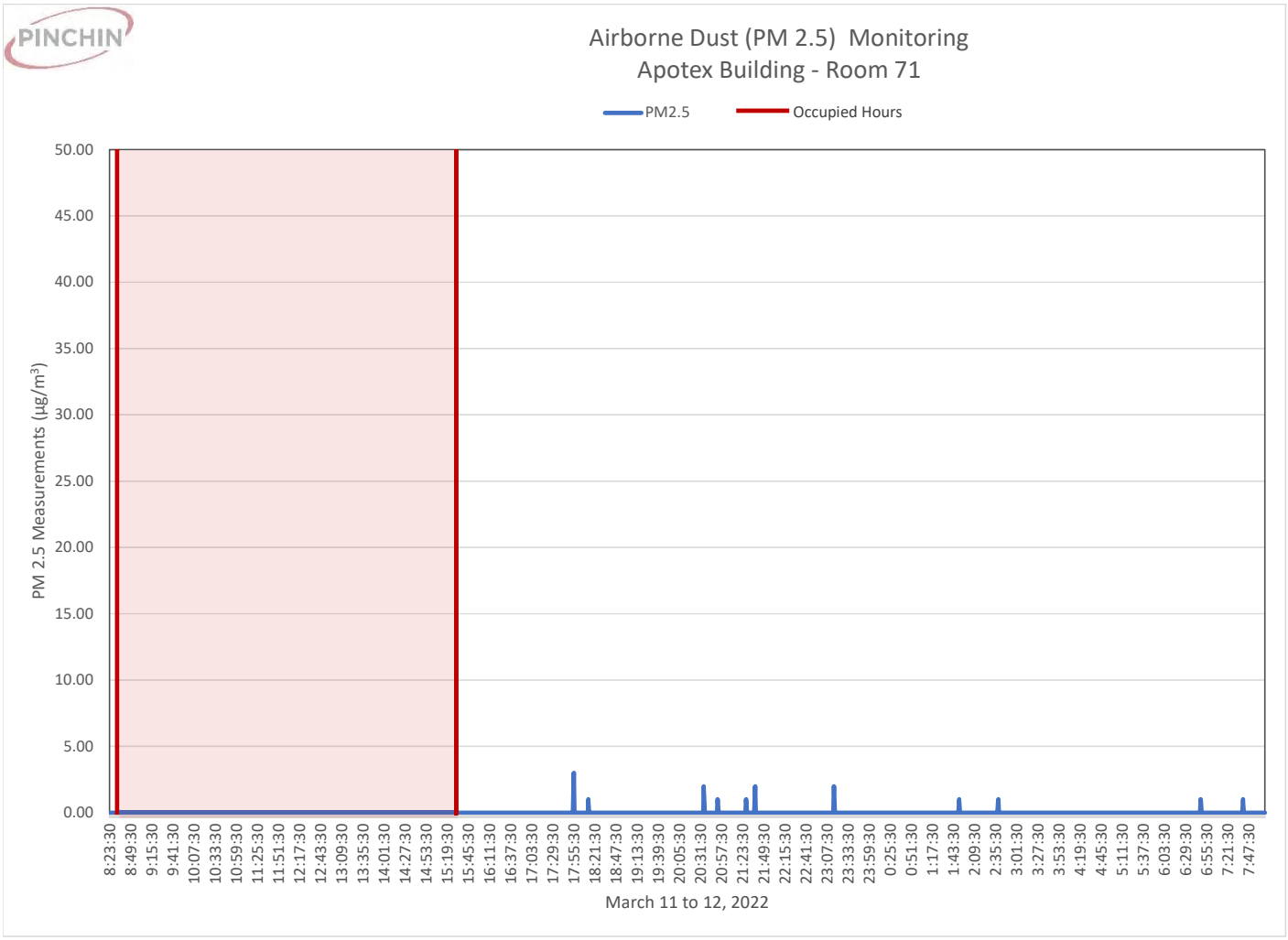

PINCHIN
TVOC Monitoring
Apotex Centre - Room 50
TVOC
Occupied Hours
Below the Detection Limit of the Instrument
TVOC Measurements (PPB)
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
9:03:20
9:29:20
9:55:20
10:21:20
10:47:20
11:13:20
11:39:20
12:05:20
12:31:20
12:57:20
13:23:20
13:49:20
14:15:20
14:41:20
15:07:20
15:33:20
15:59:20
16:25:20
16:51:20
17:17:20
17:43:20
18:09:20
18:35:20
19:01:20
19:27:20
19:53:20
20:19:20
20:45:20
21:11:20
21:37:20
22:03:20
22:29:20
22:55:20
23:21:20
23:47:20
0:13:20
0:39:20
1:05:20
1:31:20
1:57:20
2:23:20
2:49:20
3:15:20
3:41:20
4:07:20
4:33:20
4:59:20
5:25:20
5:51:20
6:17:20
6:43:20
7:09:20
7:35:20
8:01:20
March 10 to 11, 2022


PINCHIN
Carbon Dioxide Monitoring
Apotex Building - Room 71
Carbon Dioxide
Occupied Hours
Carbon Dioxide Measurements (ppm)
1000.00
950.00
900.00
850.00
800.00
750.00
700.00
650.00
600.00
550.00
500.00
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
8:23:30
8:50:30
9:17:30
9:44:30
10:11:30
10:38:30
11:05:30
11:32:30
11:59:30
12:26:30
12:53:30
13:20:30
13:47:30
14:14:30
14:41:30
15:08:30
15:35:30
16:02:30
16:29:30
16:56:30
17:23:30
17:50:30
18:17:30
18:44:30
19:11:30
19:38:30
20:05:30
20:32:30
20:59:30
21:26:30
21:53:30
22:20:30
22:47:30
23:14:30
23:41:30
0:08:30
0:35:30
1:02:30
1:29:30
1:56:30
2:23:30
2:50:30
3:17:30
3:44:30
4:11:30
4:38:30
5:05:30
5:32:30
5:59:30
6:26:30
6:53:30
7:20:30
7:47:30
March 11 to 12, 2022


PINCHIN
Carbon Monoxide Monitoring
Apotex Building - Room 71
Carbon Monoxide
Occupied Hours
Below the Detection Limit of the Instrument
Carbon Monoxide Measurements (ppm)
25.00
24.00
23.00
22.00
21.00
20.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
8:23:30
8:49:30
9:15:30
9:41:30
10:07:30
10:33:30
10:59:30
11:25:30
11:51:30
12:17:30
12:43:30
13:09:30
13:35:30
14:01:30
14:27:30
14:53:30
15:19:30
15:45:30
16:11:30
16:37:30
17:03:30
17:29:30
17:55:30
18:21:30
18:47:30
19:13:30
19:39:30
20:05:30
20:31:30
20:57:30
21:23:30
21:49:30
22:15:30
22:41:30
23:07:30
23:33:30
23:59:30
0:25:30
0:51:30
1:17:30
1:43:30
2:09:30
2:35:30
3:01:30
3:27:30
3:53:30
4:19:30
4:45:30
5:11:30
5:37:30
6:03:30
6:29:30
6:55:30
7:21:30
7:47:30
March 11 to 12, 2022


PINCHIN
Temperature Monitoring
Apotex Building - Room 71
Temperature
Occupied Hours
Temperature Measurements (°C)
50.00
47.50
45.00
42.50
40.00
37.50
35.00
32.50
30.00
27.50
25.00
22.50
20.00
17.50
15.00
12.50
10.00
7.50
5.00
2.50
0.00
8:23:30
8:49:30
9:15:30
9:41:30
10:07:30
10:33:30
10:59:30
11:25:30
11:51:30
12:17:30
12:43:30
13:09:30
13:35:30
14:01:30
14:27:30
14:53:30
15:19:30
15:45:30
16:11:30
16:37:30
17:03:30
17:29:30
17:55:30
18:21:30
18:47:30
19:13:30
19:39:30
20:05:30
20:31:30
20:57:30
21:23:30
21:49:30
22:15:30
22:41:30
23:07:30
23:33:30
23:59:30
0:25:30
0:51:30
1:17:30
1:43:30
2:09:30
2:35:30
3:01:30
3:27:30
3:53:30
4:19:30
4:45:30
5:11:30
5:37:30
6:03:30
6:29:30
6:55:30
7:21:30
7:47:30
March 11 to 12, 2022


PINCHIN
Relative Humidity Monitoring
Apotex Building - Room 71
%RH
Occupied Hours
Relative Humidty Measurements (%RH)
100.00
95.00
90.00
85.00
80.00
75.00
70.00
65.00
60.00
55.00
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
8:23:30
8:49:30
9:15:30
9:41:30
10:07:30
10:33:30
10:59:30
11:25:30
11:51:30
12:17:30
12:43:30
13:09:30
13:35:30
14:01:30
14:27:30
14:53:30
15:19:30
15:45:30
16:11:30
16:37:30
17:03:30
17:29:30
17:55:30
18:21:30
18:47:30
19:13:30
19:39:30
20:05:30
20:31:30
20:57:30
21:23:30
21:49:30
22:15:30
22:41:30
23:07:30
23:33:30
23:59:30
0:25:30
0:51:30
1:17:30
1:43:30
2:09:30
2:35:30
3:01:30
3:27:30
3:53:30
4:19:30
4:45:30
5:11:30
5:37:30
6:03:30
6:29:30
6:55:30
7:21:30
7:47:30
March 11 to 12, 2022


PINCHIN
Airborne Dust (PM 2.5) Monitoring
Apotex Building - Room 71
PM2.5
Occupied Hours
PM 2.5 Measurements (µg/m³)
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
8:23:30
8:49:30
9:15:30
9:41:30
10:07:30
10:33:30
10:59:30
11:25:30
11:51:30
12:17:30
12:43:30
13:09:30
13:35:30
14:01:30
14:27:30
14:53:30
15:19:30
15:45:30
16:11:30
16:37:30
17:03:30
17:29:30
17:55:30
18:21:30
18:47:30
19:13:30
19:39:30
20:05:30
20:31:30
20:57:30
21:23:30
21:49:30
22:15:30
22:41:30
23:07:30
23:33:30
23:59:30
0:25:30
0:51:30
1:17:30
1:43:30
2:09:30
2:35:30
3:01:30
3:27:30
3:53:30
4:19:30
4:45:30
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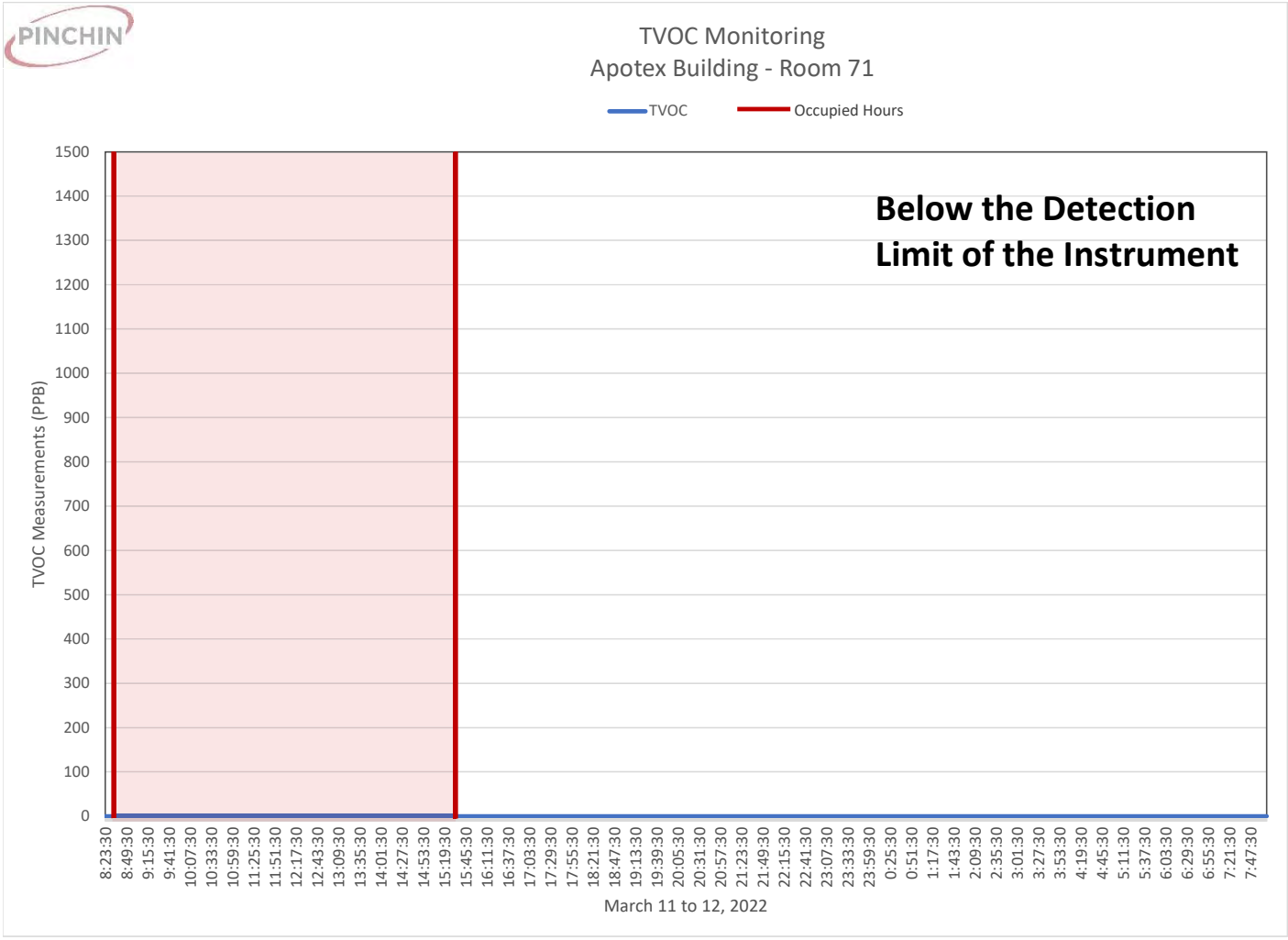
7:21:30
7:47:30
March 11 to 12, 2022


PINCHIN
TVOC Monitoring
Apotex Building - Room 71
TVOC
Occupied Hours
Below the Detection Limit of the Instrument
TVOC Measurements (PPB)
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
8:23:30
8:49:30
9:15:30
9:41:30
10:07:30
10:33:30
10:59:30
11:25:30
11:51:30
12:17:30
12:43:30
13:09:30
13:35:30
14:01:30
14:27:30
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15:19:30
15:45:30
16:11:30
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17:55:30
18:21:30
18:47:30
19:13:30
19:39:30
20:05:30
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20:57:30
21:23:30
21:49:30
22:15:30
22:41:30
23:07:30
23:33:30
23:59:30
0:25:30
0:51:30
1:17:30
1:43:30
2:09:30
2:35:30
3:01:30
3:27:30
3:53:30
4:19:30
4:45:30
5:11:30
5:37:30
6:03:30
6:29:30
6:55:30
7:21:30
7:47:30
March 11 to 12, 2022

FINAL

Investigation of Indoor Air Quality

Basic Medical Sciences Building
745 Bannatyne Avenue, Winnipeg, Manitoba

Prepared for:

University of Manitoba
120 Physical Plant, 89 Freedman Crescent
Winnipeg, Manitoba R3T 2N2

April 5, 2022

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EXECUTIVE SUMMARY

Pinchin Ltd. (Pinchin) was retained by University of Manitoba (the Client) to conduct an investigation of indoor air quality (IAQ) that included 24 hour data-log monitoring. The work was conducted at 745 Bannatyne Avenue, Winnipeg, Manitoba. Rooms 202-206, 626, and Auditoriums A and C of the Basic Medical Services Building (BMSB) were the data logging locations chosen by the client as they were to be fully occupied. Room 202-206 was to be occupied during the hours of 8:30 am to 4:30pm, Room 626 was to be occupied during the hours of 9:00 am to 5:00 pm, Auditorium A was to be occupied during the hours of 9:00 am to 12:00 pm and then from 2:00 pm to 5:00 pm while Auditorium C was to be occupied from 11:00 am to 3:00 pm. Room 202-206 and Auditoriums A and C are located on Level 200, while Room 626 is located on Level 600 of the BMSB Building at the Bannatyne Campus. The client also requested that in locations where the 24-hour monitoring occurred, observations be made specifically to the cleanliness of supply air diffusers and return air grilles. As this is a follow up to the October 19, 2021 assessment, a re-inspection of the Heating Ventilation Air Conditioning (HVAC) system was not performed.

The majority of the indoor air quality measurements collected were within recommended ranges and meet the criteria of the referenced guidelines. Carbon Dioxide concentrations suggested adequate ventilation. Carbon Monoxide concentrations did not suggest the presence of exhaust or combustion gases. Temperature measurements were within the recommended comfort ranges for office environments. Particulate Matter $PM_{2.5}$ concentrations were within typical ranges. The Pinchin inspector did not identify any deficiencies with regards to unusual odours during the investigation.

Relative Humidity measurements were below the recommended comfort range which may result in dry skin, eye and nose irritation. However, it should be noted that low relative humidity is a common wintertime condition in Canada.

There were spikes in readings for Total Volatile Organic Compounds (TVOCs) during the monitoring, specifically toward the end of day on March 9th. These spikes were likely due to activities occurring around the monitoring instrument (i.e. use of hand sanitizer or cleaning activities by staff). Pinchin does not consider this to be as an issue as the readings decrease substantially in a short period of time and the 24-hour monitoring average, as well as **the occupied time** average were well below the recommended range.

The following recommendations are offered to improve air quality in this building:

1. Communicate the findings of this report to the staff, and health and safety representative; and
2. Review the humidification system in the building to ensure it is operational and functioning properly. Consider making adjustments as necessary.

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1.0 INTRODUCTION AND SCOPE

1.1 Statement of Understanding

Pinchin Ltd. (Pinchin) was retained by University of Manitoba (the Client) to conduct an investigation of indoor air quality (IAQ) that included 24 hour data-log monitoring. The work was conducted at 745 Bannatyne Avenue, Winnipeg, Manitoba. Rooms 202-206, 626 and Auditoriums A and C of the Basic Medical Services Building (BMSB) were the data logging locations chosen by the client as they were to be fully occupied. Room 202-206 was to be occupied during the hours of 8:30 am to 4:30pm, Room 626 was to be occupied during the hours of 9:00 am to 5:00 pm, Auditorium A was to be occupied during the hours of 9:00 am to 12:00 pm and then from 2:00 pm to 5:00 pm while Auditorium C was to be occupied from 11:00 am to 3:00 pm. Room 202-206 and Auditoriums A and C are located on Level 200, while Room 626 is located on Level 600 of the BMSB Building at the Bannatyne Campus. The client also requested that in locations where the 24-hour monitoring occurred, observations be made specifically to the cleanliness of supply air diffusers and return air grilles. As this was a follow up to the October 19, 2021 assessment, a re-inspection of the Heating Ventilation Air Conditioning (HVAC) system was not performed.

1.2 Scope of Work

Pinchin performed the investigation on March 10 to March 12, 2022. The scope of this investigation was limited to Rooms 202-206, 626, as well as Auditoriums A and C.

The investigation involved the following activities:

- Walkthrough site reviews for factors that could degrade air quality; and
- 24 Hour Data-logging of Carbon Dioxide, Carbon Monoxide, Temperature, Relative Humidity (RH), Total Volatile Organic Compounds (TVOCs) and Particulate Matter smaller than 2.5 micrometres ($PM_{2.5}$) within Rooms 202-206, 626, as well as Auditoriums A and C.

2.0 METHODOLOGY

2.1 Interviews and Site Reviews

Pinchin interviewed the University of Manitoba Physical Plant, Project and Building Managers to discuss the history of the building, maintenance practices and any indoor air quality concerns.

The investigator did not perform any destructive work to inspect concealed conditions inside wall and/or ceiling cavities.

2.2 Test Methods and Criteria

The following table presents the parameters measured in this investigation, the instruments and sampling/analytical methods used, the applicable units of measurement, and the Indoor Air Quality criteria used for the evaluation of the results.

Table I – IAQ Parameters Tested, Measurement Criteria and Instruments

Parameter	Unit of Measurement	Recommended Limit	Instrumentation
Carbon dioxide, CO_2	Parts per million in air (ppm)	Outdoor Air (ppm) + 700 ppm [1]	24 hour Data-log Monitoring using a 3M® EVM-7 Air Quality Monitor
Carbon monoxide, CO	ppm	5 ppm [2]	
Temperature, T	°C	21 to 25°C, winter clothing [3]	
Relative Humidity, RH	% RH	25[4] to 65%[5], for occupant comfort	
Total Volatile Organic Compounds, (TVOC)	Parts per billion (ppb)	400 ppb[6]	
Particulate Matter smaller than 2.5 micrometres, $PM_{2.5}$	µg/m³	25 µg/m³ [7]24-hour mean;	24 hour Data-log Monitoring using an EVM-7 Air Quality Monitor

All data-logging direct-reading instruments were calibrated before use.

1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Ventilation for Acceptable Indoor Air Quality* [ANSI/ASHRAE Standard 62.1-2019]. Atlanta, GA: ASHRAE, 2019.
2 Health Canada: *Indoor Air Quality in Office Buildings: A Technical Guide*. Ottawa, ON: Health Canada, 1995.
3 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Thermal Environmental Conditions for Human Occupancy* [ANSI/ASHRAE Standard 55-2020]. Atlanta, GA: ASHRAE, 2020.
4 L.E. Burton, J.G. Girman, S.E. Womble: Airborne particulate matter within 100 randomly selected office buildings in the United States (BASE). Proceedings of Healthy Buildings 2000, Vol. 1 (2001).
5 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Thermal Environmental Conditions for Human Occupancy* [ANSI/ASHRAE Standard 55-2020]. Atlanta, GA:ASHRAE, 2020.
6 Value calculated from: US Environmental Protection Agency (EPA) "Building Assessment Survey and Evaluation (BASE) Study [Online] Available at http://www.epa.gov/iaq/base/summarized_data.html#Volatile_Organic_Compounds (Accessed August 25, 2014).
7. W. Team, "WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide : global update 2005 : summary of risk assessment", Apps.who.int, 2021. [Online]. Available: http://apps.who.int/iris/handle/10665/69477. [Accessed: 15- Sep- 2021].

3.0 FINDINGS

3.1 Results of Interviews

Project or Building Manager reported the following:

- Air Handling Units (AHU) filters are changed every three months or as needed; and
- Occupant capacities for Room 202-206 are 24 people; Theatre A is 354 people; Theatre C is 110 and Room 626 was not available

3.2 Facility Description

Table II – Facility Description

Item	Details
Construction Date	1920
Number of Floors	Five floors above grade, one floor below grade
Structural Type	Steel
Foundation Type	Concrete
Exterior Cladding	Brick
HVAC	Forced air
Roof	Built up
Flooring	Carpet
Interior Walls	Drywall
Ceilings	Acoustic ceiling tile

3.3 Results of Site Reviews

Appendix I presents the drawings.

During the investigation Pinchin noted for Rooms 202-206, and 626, as well as Auditoriums A and C that the supply diffusers and return grilles were clear from any obstructions, and were observed clean (Photos #1-6)

Refer to Table III for photographs from the investigation.

Table III – Photographs from Investigation

Photo 1 - Room 202-206 supply diffusers

Photo 2 - Room 202-206 return grate

Photo 3 - Room 626 supply diffuser

Photo 4 - Room 626 supply diffuser

Photo 5 - Auditorium A supply diffusers

Photo 6 - Auditorium C return grate

Table III – Photographs from Investigation

Photo 7 - Room 626 supply diffuser

Photo 8 - Room 626 supply diffuser

3.4 Results of Indoor Air Quality Tests

Appendix II presents the results of data-logging for IAQ parameters.

The EVM 7 air monitor was used for 24-hour data logging, for just $PM_{2.5}$, CO_2, CO, TVOC, Temperature, and Relative Humidity. The EVM-7 is a direct-reading instrument and were calibrated before use.

3.4.1 Carbon Dioxide (CO_2)

The 24-hour minimum CO_2 concentration recorded within Room 202-206 was 364 ppm, the maximum CO_2 concentration was 855 ppm. The 24- hour average for CO_2 was 472 ppm. The average CO_2 concentration during **the occupied time** was 609 ppm. On March 10 and March 11 outdoor spot measurements were recorded. The average outdoor CO2 spot measurements for the two days was 410 ppm. The indoor Carbon Dioxide concentrations were below the limit of 1,172 ppm (472 ppm outdoors plus 700 ppm) recommended by American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) to provide indoor air quality acceptable to the majority of occupants. This indicates that the supply of outdoor air was adequate for the occupancy loading at the time of the investigation.

The 24-hour minimum CO_2 concentration recorded within Room 626 was 380 ppm, the maximum CO_2 concentration was 501 ppm. The 24- hour average for CO_2 was 421 ppm. The average CO_2 concentration during **the occupied time** was 460 ppm. On March 11 and March 12 outdoor spot measurements were recorded. The average outdoor CO2 spot measurements for the two days was 409 ppm. The indoor Carbon Dioxide concentrations were below the limit of 1,121 ppm (421 ppm outdoors plus 700 ppm) recommended by American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) to provide indoor air quality acceptable to the majority of occupants. This indicates that the supply of outdoor air was adequate for the occupancy loading at the time of the investigation.

The 24-hour minimum CO_2 concentration recorded within Auditorium A was 385 ppm, the maximum CO_2 concentration was 495 ppm. The 24- hour average for CO_2 was 413 ppm. The average CO_2 concentration during **the occupied time** was 441 ppm. On March 11 and March 12 outdoor spot measurements were recorded. The average outdoor CO2 spot measurements for the two days was 409 ppm. The indoor Carbon Dioxide concentrations were below the limit of 1,121 ppm (421 ppm outdoors plus 700 ppm) recommended by American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) to provide indoor air quality acceptable to the majority of occupants. This indicates that the supply of outdoor air was adequate for the occupancy loading at the time of the investigation.

The 24-hour minimum CO_2 concentration recorded within Auditorium C was 459 ppm, the maximum CO_2 concentration was 636 ppm. The 24- hour average for CO_2 was 514 ppm. The average CO_2 concentration during **the occupied time** was 564 ppm. On March 11 and March 12 outdoor spot measurements were recorded. The average outdoor CO2 spot measurements for the two days was 409 ppm. The indoor Carbon Dioxide concentrations were below the limit of 1,121 ppm (421 ppm outdoors plus 700 ppm) recommended by American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) to provide indoor air quality acceptable to the majority of occupants. This indicates that the supply of outdoor air was adequate for the occupancy loading at the time of the investigation.

3.4.2 Carbon Monoxide (CO)

The 24-hour minimum CO concentration within Room 202-206 was below the detection limit of the instrumentation, the maximum CO concentration was 1 ppm. The 24-hour average for CO was 0.44 ppm. The average CO concentration during **the occupied time** was 0.97 ppm. On March 10 and March 11 outdoor spot measurements were recorded. The average outdoor CO spot measurements for the two days was below the detection limit of the instrumentation.

The carbon monoxide concentrations were non-detectable or just at the detection limit of the instrumentation for the duration of the 24-hour monitoring in Room 626, Auditorium A, and Auditorium C. Health Canada advises that the detection of carbon monoxide above 5 ppm indicates a concern requiring further investigation.

3.4.3 Temperature (Temp)

The 24-hour minimum Temperature measurement for Room 202-206 was 19.1 °C, the maximum Temperature measurement was 24.5 °C. The 24-hour average for Temperature measurement in Room 202-206 was 22.6 °C. The average Temperature measurements during **the occupied time** in Room 202-206 was 23.3 °C. All Temperatures were within the recommended comfort ranges for office environments for typical dress during winter conditions, of 21 to 25 °C.

The 24-hour minimum Temperature measurement for Room 626 was 20.9 °C, the maximum Temperature measurement was 25.6 °C. The 24-hour average for Temperature measurement in Room 626 was 24.9 °C. The average Temperature measurements during **the occupied time** in Room 626 was 25.0 °C. All Temperatures were within the recommended comfort ranges for office environments for typical dress during winter conditions, of 21 to 25 °C.

The 24-hour minimum Temperature measurement for Auditorium A was 20.1 °C, the maximum Temperature measurement was 21.3 °C. The 24-hour average for Temperature measurement in Auditorium A was 20.7 °C. The average Temperature measurements during **the occupied time** in Auditorium A was 20.8 °C, On March 11 and March 12 outdoor spot measurements were taken each day. The average outdoor Temperature spot measurements for the two days was -22.0 °C. The Temperatures were outside the recommended comfort ranges for office environments for typical dress during winter conditions, of 21 to 25 °C. Temperature preferences are, however, very personal and these conditions might be acceptable to the occupants.

The 24-hour minimum Temperature measurement for Auditorium C was 21. °C, the maximum Temperature measurement was 22.5 °C. The 24-hour average for Temperature measurement in Auditorium C was 21.8 °C. The average Temperature measurements during **the occupied time** in Auditorium C was 22.0 °C. All Temperatures were within the recommended comfort ranges for office environments for typical dress during winter conditions, of 21 to 25 °C.

On March 11 and March 12 outdoor spot measurements were taken each day. The average outdoor Temperature spot measurements for the two days was -22.0 °C.

3.4.4 Relative Humidity (RH)

The 24-hour minimum Relative Humidity measurement for Room 202-206 was 2.2 %RH, the maximum Relative Humidity measurement was 9.3 %RH. The 24-hour average measurement for Relative Humidity averaged 5.0 %RH. The average Relative Humidity measurements during **the occupied time** was 5.1 %RH. Relative humidity below 25 %RH may result in complaints of dry skin and eye and nose irritation. Low relative humidity is a common winter time condition in Canada due to difficulties with humidification.

The 24-hour minimum Relative Humidity measurement for Room 626 was 6.1 %RH, the maximum Relative Humidity measurement was 16.2 %RH. The 24-hour average measurement for Relative Humidity averaged 10.2 %RH. The average Relative Humidity measurements during **the occupied time** was 10.5 %RH. On March 10 and March 11 outdoor spot measurements were taken each day. Relative humidity below 25 %RH may result in complaints of dry skin and eye and nose irritation. Low relative humidity is a common winter time condition in Canada due to difficulties with humidification.

The 24-hour minimum Relative Humidity measurement for Auditorium A was 2.2 %RH, the maximum Relative Humidity measurement was 4.1 %RH. The 24-hour average measurement for Relative Humidity averaged 2.6 %RH. The average Relative Humidity measurements during **the occupied time** was 2.9 %RH. Relative humidity below 25 %RH may result in complaints of dry skin and eye and nose irritation. Low relative humidity is a common winter time condition in Canada due to difficulties with humidification.

The 24-hour minimum Relative Humidity measurement for Auditorium C was 0.4 %RH, the maximum Relative Humidity measurement was 3.9 %RH. The 24-hour average measurement for Relative Humidity averaged 0.9 %RH. The average Relative Humidity measurements during **the occupied time** was 1.3 %RH. Relative humidity below 25 %RH may result in complaints of dry skin and eye and nose irritation. Low relative humidity is a common winter time condition in Canada due to difficulties with humidification.

On March 10 and March 11 outdoor spot measurements were taken each day. The average outdoor Relative Humidity spot measurements for the two days was 65.0 %RH.

3.4.5 Particulate Matter ($PM_{2.5}$)

The 24-hour minimum concentration for $PM_{2.5}$ within Room 202-206 was below the detection limits of the monitoring instrument, the maximum concentration for $PM_{2.5}$ was 6 µg/m³. The 24 hour average concentration for $PM_{2.5}$ was 0.03 µg/m³. The average $PM_{2.5}$ concentrations during **the occupied time** was 0.03 µg/m³. For reference, World Health Organization (WHO) provides a guideline of 25 µg/m³ over a 24-hour period. The $PM_{2.5}$ concentrations in this building fell within the range typically measured in commercial buildings.

The 24-hour minimum concentration for $PM_{2.5}$ within Room 626 was below the detection limits of the monitoring instrument, the maximum concentration for $PM_{2.5}$ was 58 µg/m³. The 24 hour average concentration for $PM_{2.5}$ was 1 µg/m³. The average $PM_{2.5}$ concentrations during **the occupied time** was 0.65 µg/m³. For reference, World Health Organization (WHO) provides a guideline of 25 µg/m³ over a 24-hour period. The $PM_{2.5}$ concentrations in this building fell within the range typically measured in commercial buildings.

The 24-hour minimum concentration for $PM_{2.5}$ within Auditorium A was below the detection limits of the monitoring instrument, the maximum concentration for $PM_{2.5}$ was 4 µg/m³. The 24 hour average concentration for $PM_{2.5}$ was 0.03 µg/m³. The average $PM_{2.5}$ concentrations during **the occupied time** was 0.05 µg/m³. For reference, World Health Organization (WHO) provides a guideline of 25 µg/m³ over a 24-hour period. The $PM_{2.5}$ concentrations in this building fell within the range typically measured in commercial buildings.

The 24-hour minimum concentration for $PM_{2.5}$ within Auditorium C was below the detection limits of the monitoring instrument, the maximum concentration for $PM_{2.5}$ was 7 µg/m³. The 24 hour average concentration for $PM_{2.5}$ was 1 µg/m³. The average $PM_{2.5}$ concentrations during **the occupied time** was 1 µg/m³.. For reference, World Health Organization (WHO) provides a guideline of 25 µg/m³ over a 24-hour period. The $PM_{2.5}$ concentrations in this building fell within the range typically measured in commercial buildings.

On March 10 and March 11 outdoor spot measurements were taken each day. The average outdoor $PM_{2.5}$ spot measurements for the two days was 9 µg/m³

3.4.6 Total Volatile Organic Compounds (TVOC)

The 24-hour minimum concentrations for TVOC within Room 202-206 was below the detection limits of the monitoring instrument, the maximum was 3,400 ppb. The 24-hour average for TVOCs was 51 ppb. The average TVOC concentrations during **the occupied time** was 10 ppb. Based on US EPA research, office environments with TVOC concentrations up to about 400 ppb would be at little risk of IAQ complaint. Complaints might be expected if concentrations were significantly above 400 ppb.

There were spikes in readings for Total Volatile Organic Compounds (TVOCs) during the monitoring, specifically toward the end of day on March 9th. These spikes were likely due to activities occurring around the monitoring instrument (i.e. use of hand sanitizer or cleaning activities by staff). Pinchin does not consider this to be as an issue as the readings decrease substantially in a short period of time and the 24-hour monitoring average, as well as **the occupied time** average were well below the recommended range.

On March 10 and March 11 outdoor spot measurements were taken and recorded as below the detection limit of the monitoring instrument for both dates.

The TVOC concentrations were non-detectable or just at the detection limit of the instrumentation within Room 626, and also Auditorium A and C for the duration of the 24-hour monitoring. Based on US EPA research, office environments with TVOC concentrations up to 400 ppb would be at little risk of IAQ concern. As this is a guideline, complaints might be expected if concentrations were significantly above 400 ppb.

Table IV – Summary of 24-Hour Data-logging IAQ based on Indoor Air Quality Criteria

Parameter	Measurement Average	Indoor Air Quality Measurement Criteria	Below Indoor Air Quality Measurement Criteria?
Carbon Dioxide	Room 202-206 472 ppm	Outdoor Air (ppm) + 700 ppm	Yes
	Room 626 421 ppm		
	Auditorium A 413 ppm		
	Auditorium C 514 ppm		
Carbon Monoxide	Room 202-206 0.44 ppm	5ppm	Yes
	Room 626 0 ppm		
	Auditorium A 0 ppm		
	Auditorium C 0 ppm		

Table IV – Summary of 24-Hour Data-logging IAQ based on Indoor Air Quality Criteria

Parameter	Measurement Average	Indoor Air Quality Measurement Criteria	Below Indoor Air Quality Measurement Criteria?
Temperature (°C)	Room 202-206 22.6 °C	21 to 25 °C, winter clothing	Yes
	Room 626 24.9 °C		Yes
	Auditorium A 20.7 °C		No
	21.8 °C		Yes
Relative Humidity (%)	Room 202-206 5.0 %	25 to 65 %, for occupant comfort	No
	Room 626 10.2 %		
	Auditorium A 2.6 %		
	Auditorium C 0.9 %		

Table IV – Summary of 24-Hour Data-logging IAQ based on Indoor Air Quality Criteria

Parameter	Measurement Average	Indoor Air Quality Measurement Criteria	Below Indoor Air Quality Measurement Criteria?
$PM_{2.5}$	Room 202-206 0.03 µg/m³	25 µg/m³	Yes
	Room 626 1 µg/m³		
	Auditorium A 0.03 µg/m³		
	Auditorium C 1 µg/m³		
TVOC	Room 202-206 51 ppb	400 ppb	Yes
	Room 626 **Below the Detection Limit of the Monitoring Instrument**		
	Auditorium A **Below the Detection Limit of the Monitoring Instrument**		
	Auditorium C **Below the Detection Limit of the Monitoring Instrument**		

4.0 DISCUSSION

The majority of the indoor air quality measurements collected were within recommended ranges and meet the criteria of the referenced guidelines. Carbon Dioxide concentrations suggested adequate ventilation. Carbon Monoxide concentrations did not suggest the presence of exhaust or combustion gases. Temperature measurements were within the recommended comfort ranges for office environments. Particulate Matter $PM_{2.5}$ concentrations were within typical ranges. The Pinchin inspector did not identify any deficiencies with regards to unusual odours during the investigation.

Temperature measurements were below the recommended comfort range for commercial environments within Auditorium A. Temperature preferences are, however, very personal and these conditions might be acceptable to the occupants.

Relative Humidity measurements were below the recommended comfort range which may result in dry skin, eye and nose irritation. However, it should be noted that low relative humidity is a common wintertime condition in Canada.

There were spikes in readings for Total Volatile Organic Compounds (TVOCs) during the monitoring, specifically toward the end of day on March 9th. These spikes were likely due to activities occurring around the monitoring instrument (i.e. use of hand sanitizer or cleaning activities by staff). Pinchin does not consider this to be as an issue as the readings decrease substantially in a short period of time and the 24-hour monitoring average, as well as **the occupied time** average were well below the recommended range.

5.0 RECOMMENDATIONS

Pinchin offers the following recommendations to improve air quality in this building.

1. Communicate the findings of this report to the staff, and health and safety representative.
2. Review the humidification system in the building to ensure it is operational and functioning properly. Consider making adjustments as necessary.

6.0 TERMS AND LIMITATIONS

This work was performed subject to the Terms and Limitations presented or referenced in the proposal for this project.

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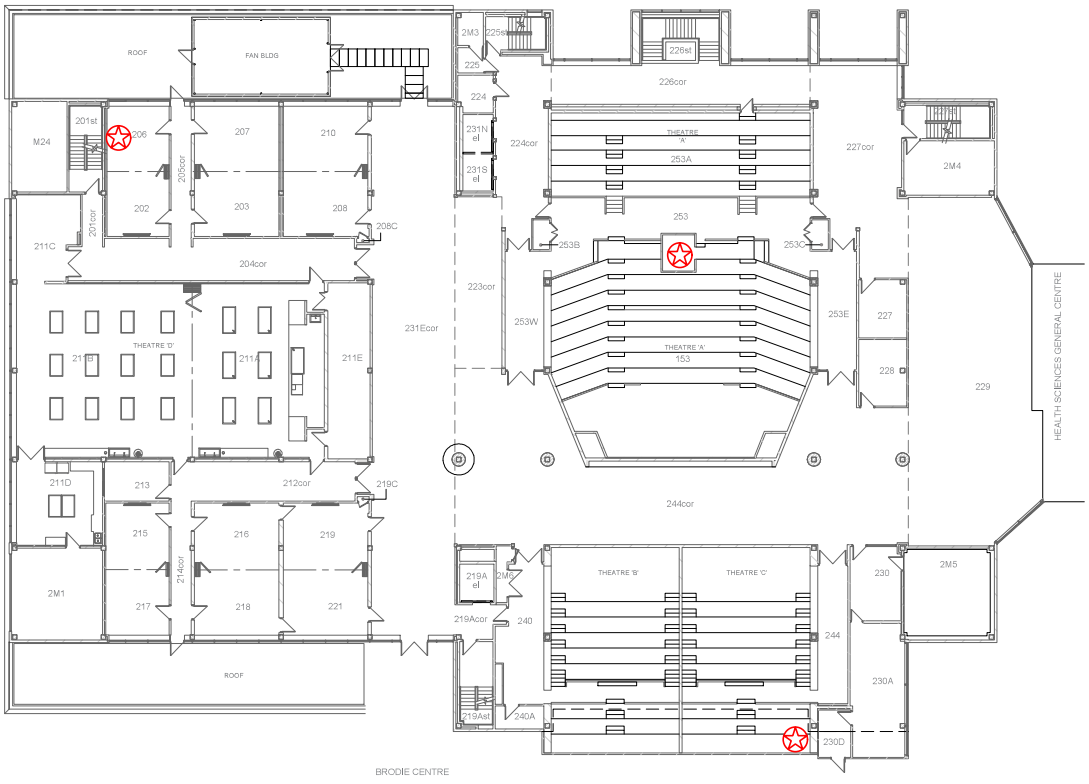
\\pinchin.com\wpg\Job\306000s\0306866.000 UofM,89FREEDMAN,IAQ,ASSMNT\Deliverables\BMSB\306866 FINAL IAQ Report BMSB 745 Bannatyne Ave, Wpg, MB, U of M, Apr 4, 2022.docx

Template: Master Report Investigation of IAQ, IEQ, September 15, 2021

APPENDIX I

Drawings



N

LEGEND

DATA LOGGING LOCATION

BASE PLAN PROVIDED BY CLIENT.

PINCHIN

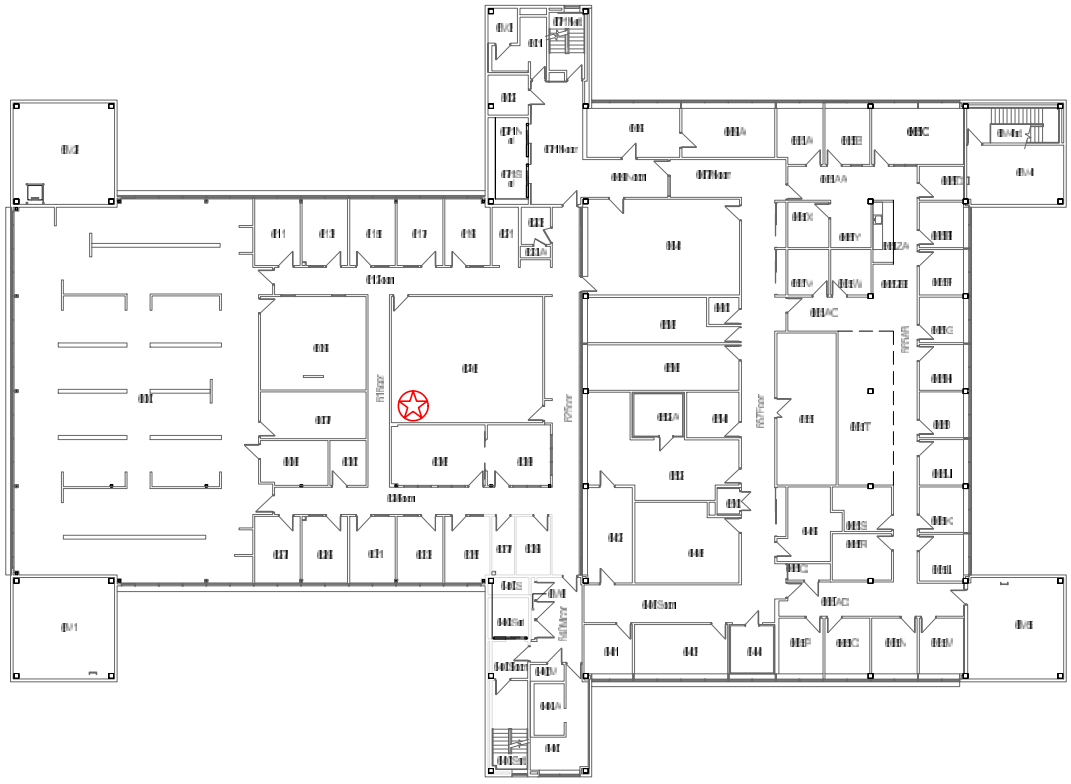
PROJECT NAME:
INDOOR AIR QUALITY ASSESSMENT

CLIENT NAME:
UNIVERSITY OF MANITOBA

PROJECT LOCATION:
BASIC MEDICAL SCIENCES BUILDING
745 BANNATYNE AVENUE
WINNIPEG, MANITOBA

FIGURE NAME:
LEVEL 200

PROJECT NUMBER:	SCALE:
306866	NOT TO SCALE
DRAWN BY:	REVIEWED BY:
CE	JB
DATE:	FIGURE NUMBER:
APRIL 2022	1 OF 2



N

LEGEND

DATA LOGGING LOCATION

BASE PLAN PROVIDED BY CLIENT.

PINCHIN

PROJECT NAME:
INDOOR AIR QUALITY ASSESSMENT

CLIENT NAME:
UNIVERSITY OF MANITOBA

PROJECT LOCATION:
BASIC MEDICAL SCIENCES BUILDING
745 BANNATYNE AVENUE
WINNIPEG, MANITOBA

FIGURE NAME:
LEVEL 600

PROJECT NUMBER:	SCALE:
306866	NOT TO SCALE
DRAWN BY:	REVIEWED BY:
ce	JB
DATE:	FIGURE NUMBER:
APRIL 2022	2 OF 2

APPENDIX II

Results of Data-Logging Indoor Air Quality Measurements

Session Report
Basic Medical Services Building Room 202-206
745 Bannatyne Avenue

3/11/2022

Datalog Period

Device Name	EML110005
Serial Number	EML110005
Run Time	1.00:01:46
Start Time	3/10/2022 7:52:38 AM
Stop Time	3/11/2022 7:54:24 AM

IAQ Data Summary

Description	Value	Description	Value
CO2Ave	472 PPM	CO2Max	855 PPM
CO2MaxTime	3/10/2022 11:40:22 AM	CO2Min	364 PPM
COAve	0.44 PPM	COMax	1 PPM
COMin	0 PPM	Dust Average	0.03 ug/m³
Dust Max	6.000 ug/m³	Dust Min	0.000 ug/m³
Humidity Avg	5.0 %	Humidity Max	9.3 %
Humidity Max Time	3/10/2022 7:52:56 AM	Humidity Min	2.2 %
Humidity Min Time	3/11/2022 7:56:18 AM	PIDAvePPB	51 PPB
PIDMaxPPB	3,400 PPB	PIDMinPPB	Below the Detection Limit of the Monitoring Instrument
Temp Avg	22.6 °C	Temp Max Time	3/10/2022 2:44:31 PM
Temp Min Time	3/10/2022 7:52:38 AM	Temperature Max	24.5 °C
Temperature Min	19.1 °C		
Dust Impactor Setting	2.5 µm		

Session Report
Basic Medical Sciences Building Auditorium C
745 Bannatyne Avenue

3/12/2022

Datalog Period

Device Name	EMI030004
Serial Number	EMI030004
Run Time	1.00:04:20
Start Time	3/11/2022 7:48:56 AM
Stop Time	3/12/2022 7:53:16 AM

IAQ Data Summary

Description	Value	Description	Value
CO2Ave	514 PPM	CO2Max	636 PPM
CO2MaxTime	3/11/2022 11:27:14 AM	CO2Min	459 PPM
COAve	0 PPM	COMax	0 PPM
COMin	0 PPM	Dust Average	1.000 ug/m³
Dust Max	7.000 ug/m³	Dust Min	0.000 ug/m³
Humidity Avg	0.9 %	Humidity Max	3.9 %
Humidity Max Time	3/11/2022 7:48:55 AM	Humidity Min	0.4 %
Humidity Min Time	3/12/2022 7:50:36 AM	PIDAvePPB	Below the Detection Limit of the Monitoring Instrument
PIDMaxPPB	Below the Detection Limit of the Monitoring Instrument	PIDMinPPB	Below the Detection Limit of the Monitoring Instrument
Temp Avg	21.8 °C	Temp Max Time	3/11/2022 7:49:35 AM
Temp Min Time	3/12/2022 6:58:52 AM	Temperature Max	22.5 °C
Temperature Min	21.4 °C		
Dust Impactor Setting	2.5 µm		

Session Report
Basic Medical Sciences Building Room 626
745 Bannatyne Avenue

3/12/2022

Datalog Period

Device Name	EMM120003
Serial Number	EMM120003
Run Time	23:37:34
Start Time	3/11/2022 8:10:37 AM
Stop Time	3/12/2022 7:48:11 AM

IAQ Data Summary

Description	Value	Description	Value
CO2Ave	421 PPM	CO2Max	501 PPM
CO2MaxTime	3/11/2022 4:25:43 PM	CO2Min	380 PPM
COAve	0 PPM	COMax	0 PPM
COMin	0 PPM	Dust Average	1.000 ug/m³
Dust Max	58.000 ug/m³	Dust Min	0.000 ug/m³
Humidity Avg	10.2 %	Humidity Max	16.2 %
Humidity Max Time	3/11/2022 8:10:55 AM	Humidity Min	6.1 %
Humidity Min Time	3/12/2022 6:34:37 AM	PIDAvePPB	Below the Detection Limit of the Monitoring Instrument
PIDMaxPPB	Below the Detection Limit of the Monitoring Instrument	PIDMinPPB	Below the Detection Limit of the Monitoring Instrument
Temp Avg	24.9 °C	Temp Max Time	3/11/2022 12:43:35 PM
Temp Min Time	3/11/2022 8:10:37 AM	Temperature Max	25.6 °C
Temperature Min	20.9 °C		
Dust Impactor Setting	2.5 µm		

Session Report
Basic Medical Sciences Building Auditorium A
745 Bannatyne Avenue

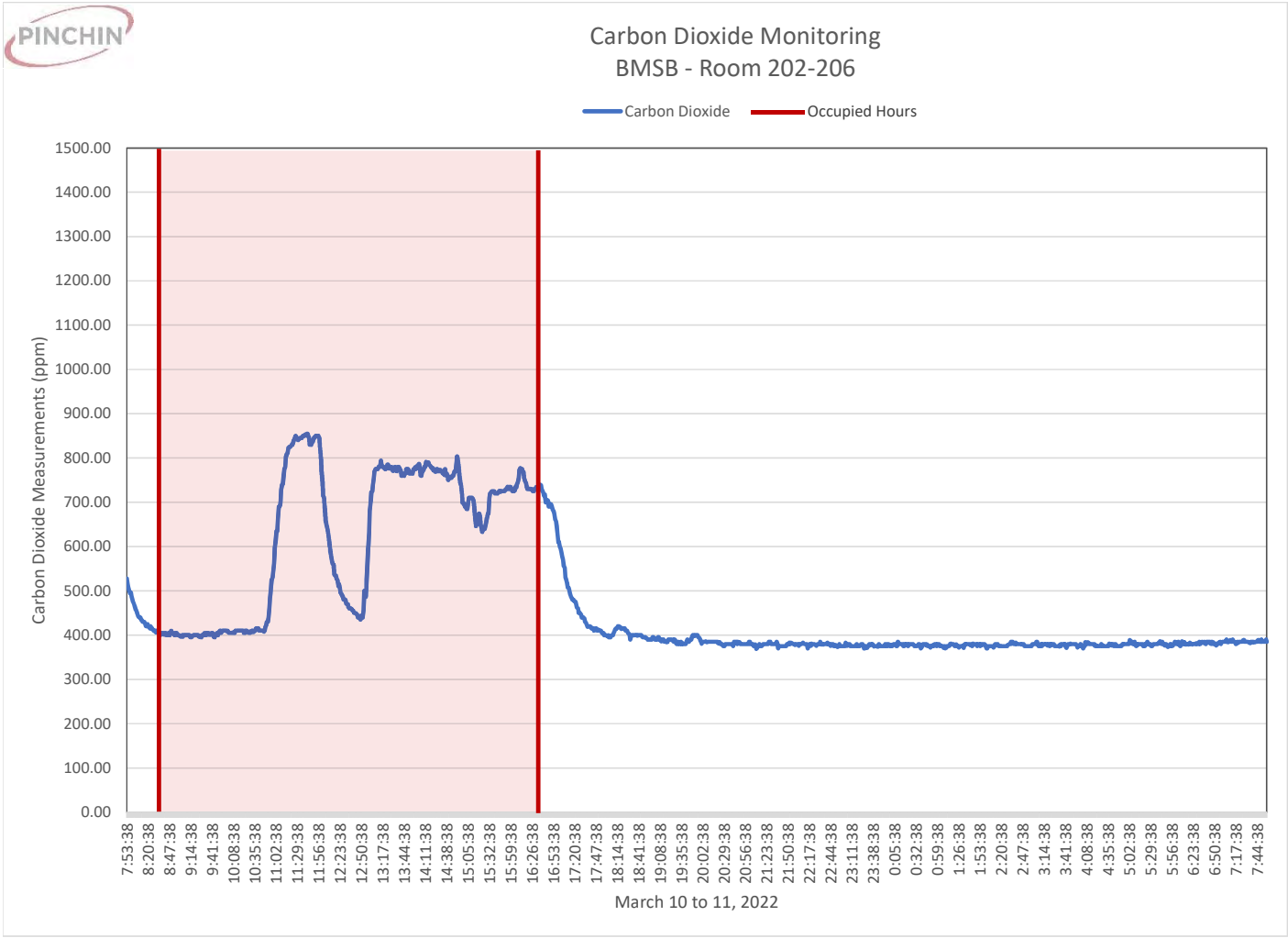
3/12/2022

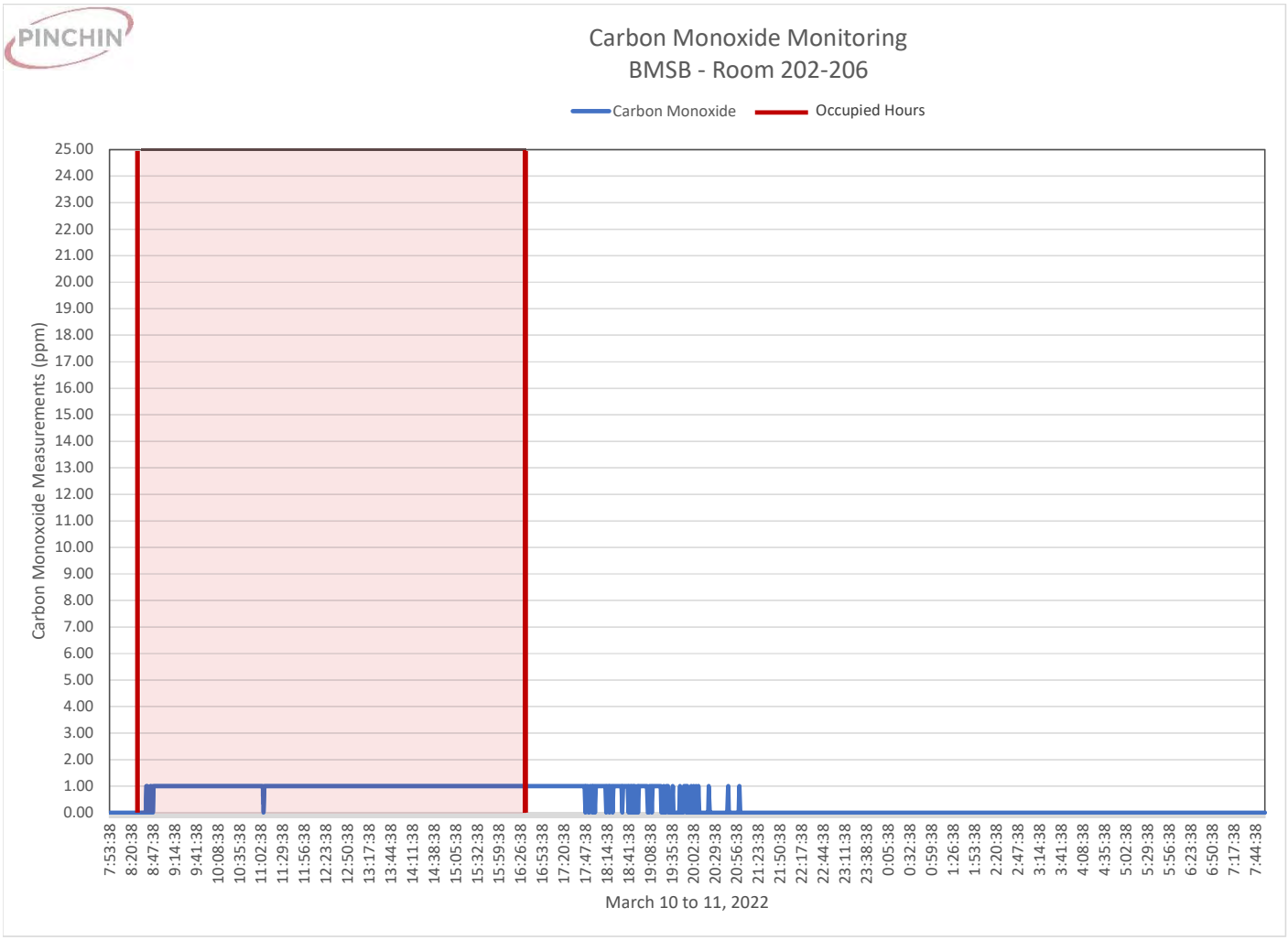
Datalog Period

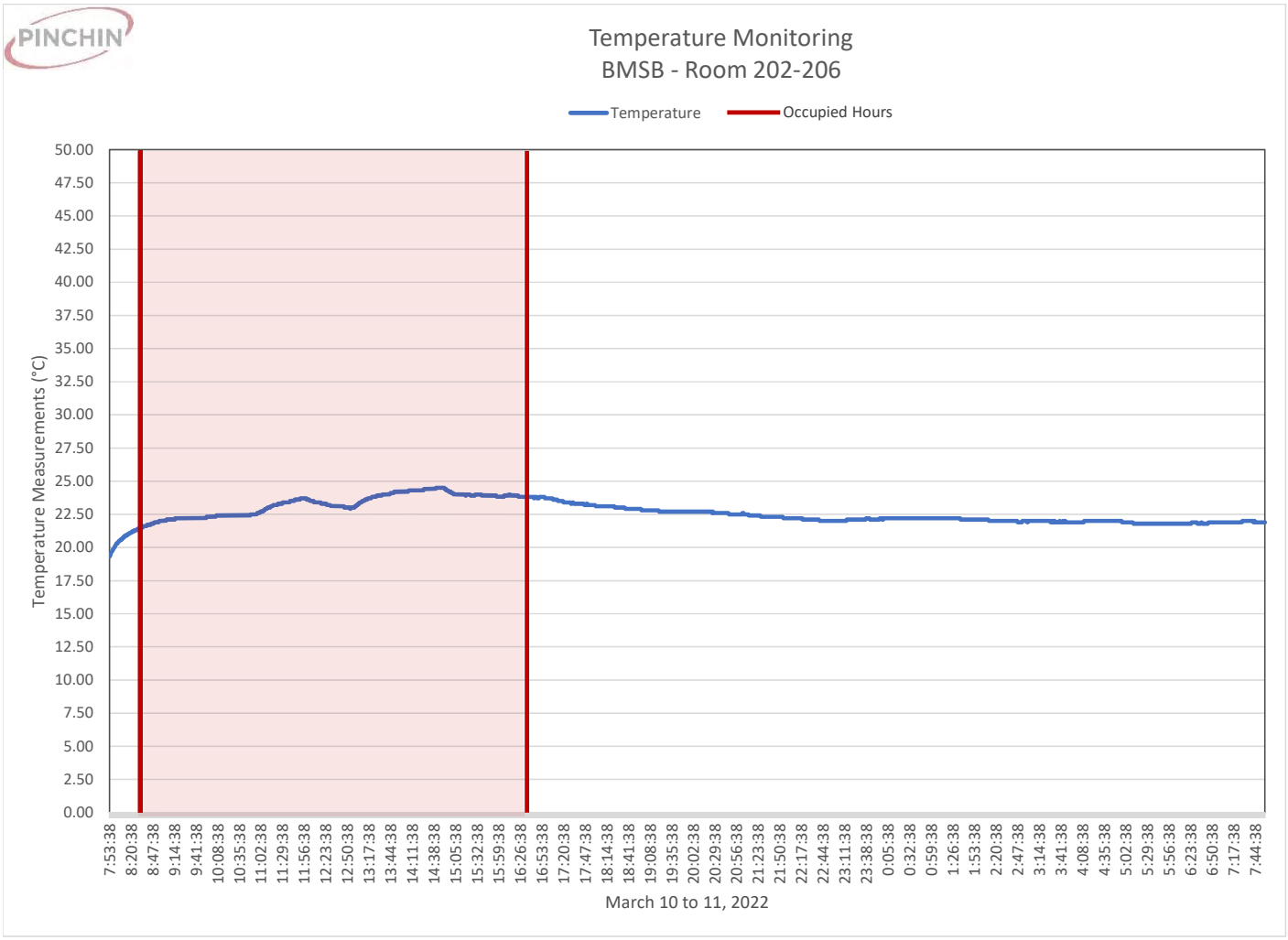
Device Name	EML110005
Serial Number	EML110005
Run Time	23:56:19
Start Time	3/11/2022 7:58:40 AM
Stop Time	3/12/2022 7:54:59 AM

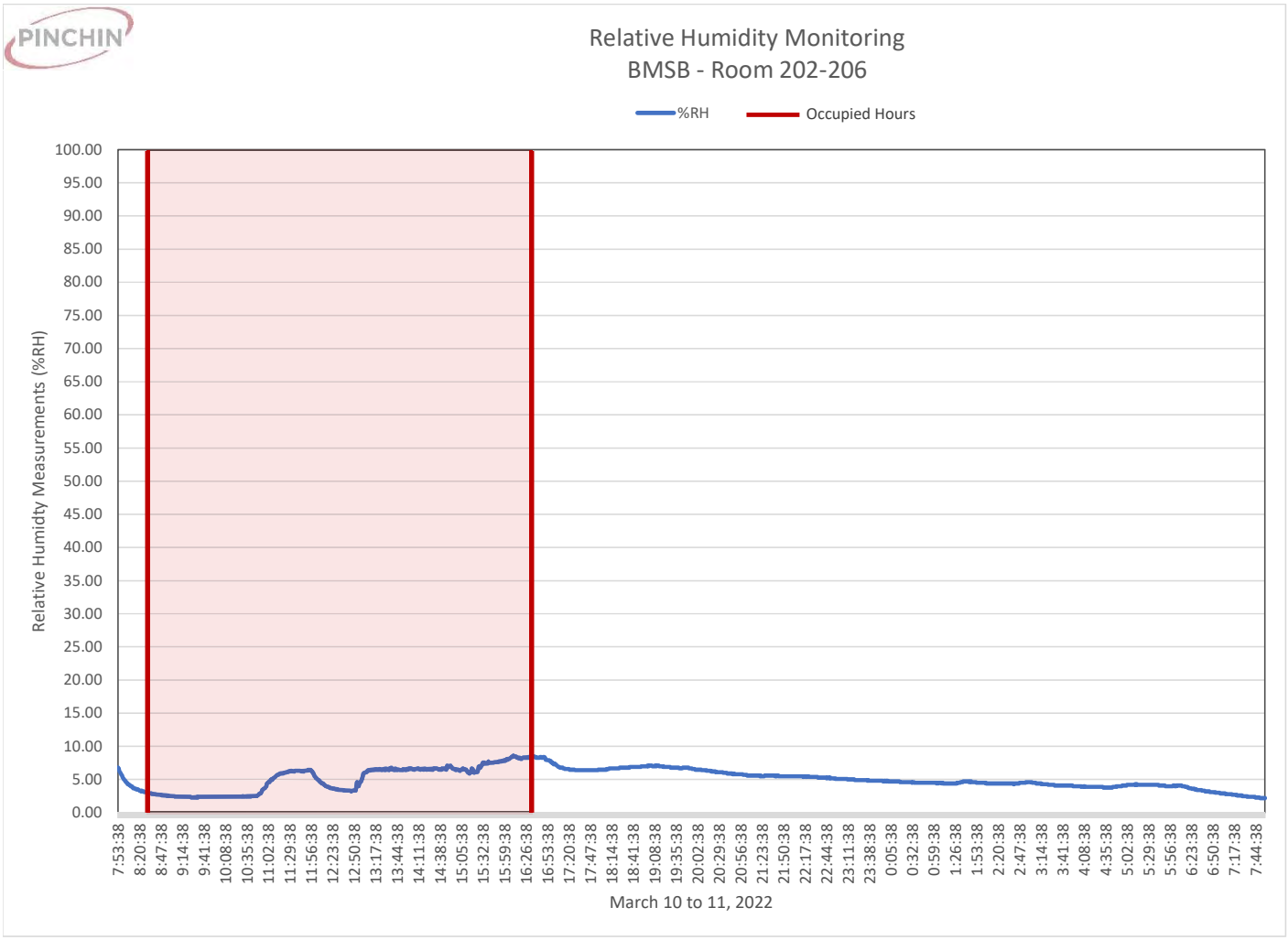
IAQ Data Summary

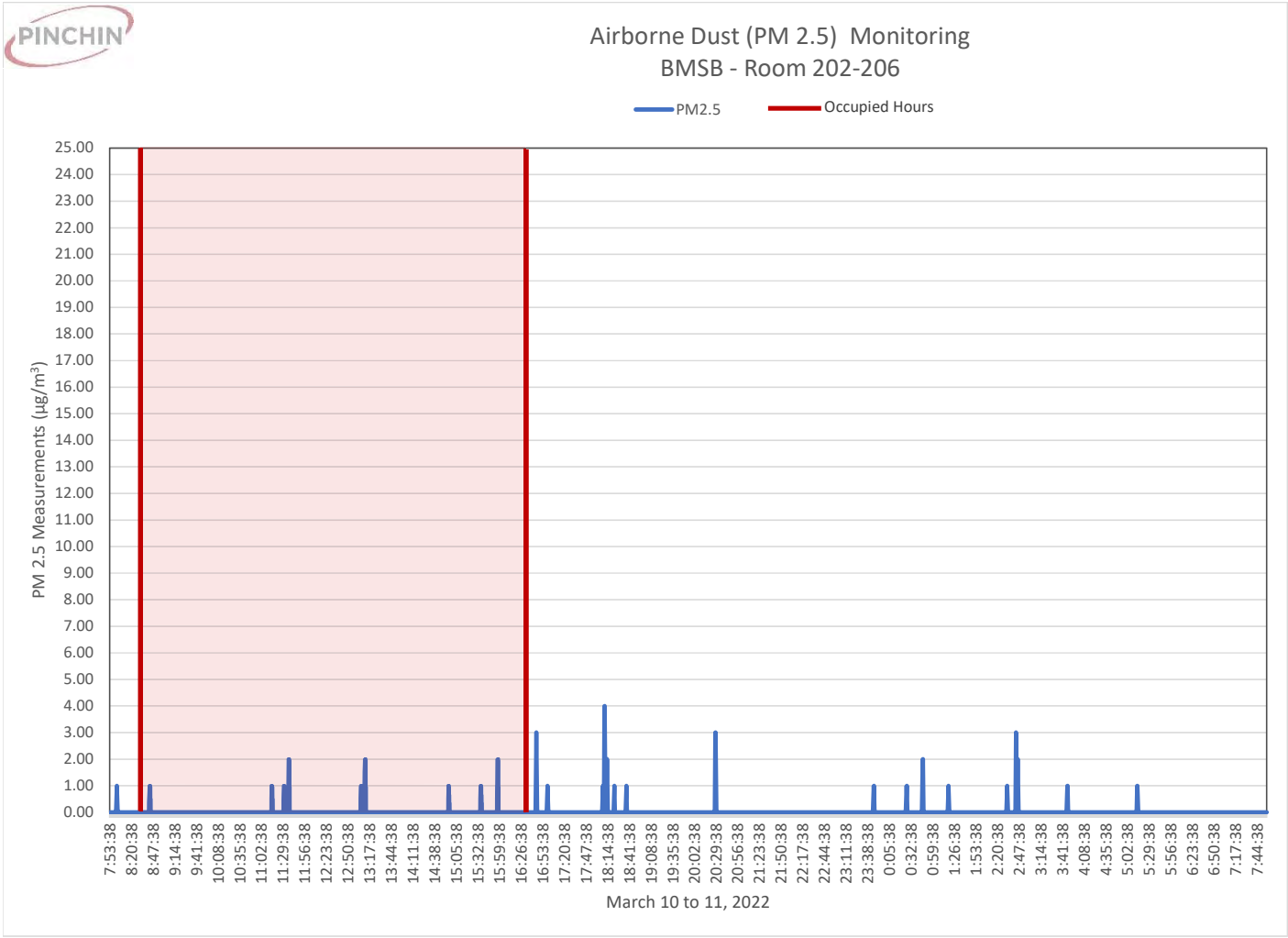
Description	Value	Description	Value
CO2Ave	413 PPM	CO2Max	495 PPM
CO2MaxTime	3/11/2022 10:32:25 AM	CO2Min	385 PPM
COAve	0 PPM	COMax	0 PPM
COMin	0 PPM	Dust Average	0.03 ug/m³
Dust Max	4.000 ug/m³	Dust Min	0.000 ug/m³
Humidity Avg	2.6 %	Humidity Max	4.1 %
Humidity Max Time	3/11/2022 7:58:46 AM	Humidity Min	2.2 %
Humidity Min Time	3/12/2022 7:29:01 AM	PIDAvePPB	Below the Detection Limit of the Monitoring Instrument
PIDMaxPPB	Below the Detection Limit of the Monitoring Instrument	PIDMinPPB	Below the Detection Limit of the Monitoring Instrument
Temp Avg	20.7 °C	Temp Max Time	3/12/2022 7:26:59 AM
Temp Min Time	3/11/2022 9:50:47 PM	Temperature Max	21.3 °C
Temperature Min	20.1 °C		
Dust Impactor Setting	2.5 µm		

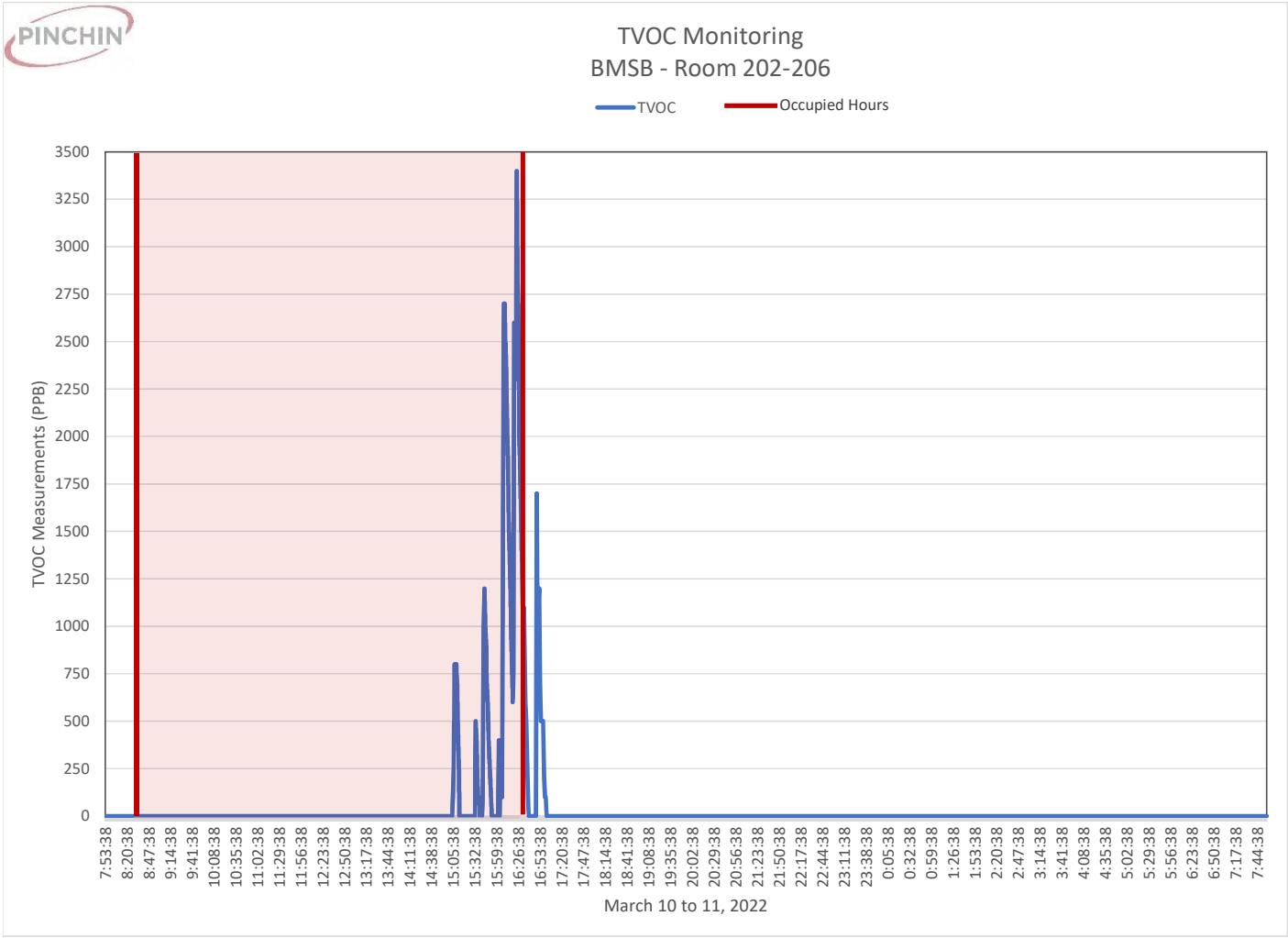

PINCHIN
Carbon Dioxide Monitoring
BMSB - Room 202-206
Carbon Dioxide
Occupied Hours
Carbon Dioxide Measurements (ppm)
1500.00
1400.00
1300.00
1200.00
1100.00
1000.00
900.00
800.00
700.00
600.00
500.00
400.00
300.00
200.00
100.00
0.00
7:53:38
8:20:38
8:47:38
9:14:38
9:41:38
10:08:38
10:35:38
11:02:38
11:29:38
11:56:38
12:23:38
12:50:38
13:17:38
13:44:38
14:11:38
14:38:38
15:05:38
15:32:38
15:59:38
16:26:38
16:53:38
17:20:38
17:47:38
18:14:38
18:41:38
19:08:38
19:35:38
20:02:38
20:29:38
20:56:38
21:23:38
21:50:38
22:17:38
22:44:38
23:11:38
23:38:38
0:05:38
0:32:38
0:59:38
1:26:38
1:53:38
2:20:38
2:47:38
3:14:38
3:41:38
4:08:38
4:35:38
5:02:38
5:29:38
5:56:38
6:23:38
6:50:38
7:17:38
7:44:38
March 10 to 11, 2022

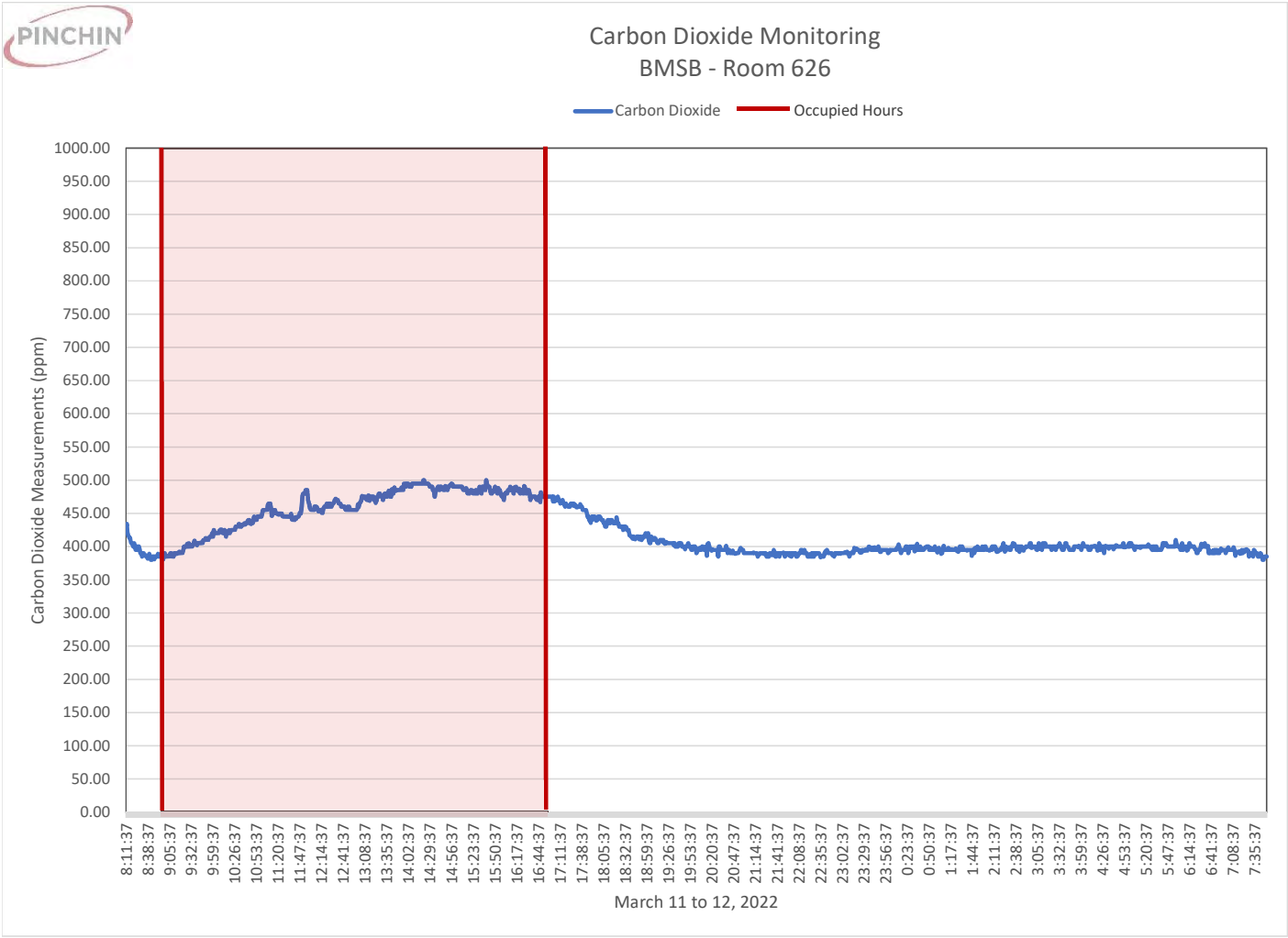

PINCHIN
Carbon Monoxide Monitoring
BMSB - Room 202-206
Carbon Monoxide
Occupied Hours
Carbon Monoxide Measurements (ppm)
25.00
24.00
23.00
22.00
21.00
20.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
7:53:38
8:20:38
8:47:38
9:14:38
9:41:38
10:08:38
10:35:38
11:02:38
11:29:38
11:56:38
12:23:38
12:50:38
13:17:38
13:44:38
14:11:38
14:38:38
15:05:38
15:32:38
15:59:38
16:26:38
16:53:38
17:20:38
17:47:38
18:14:38
18:41:38
19:08:38
19:35:38
20:02:38
20:29:38
20:56:38
21:23:38
21:50:38
22:17:38
22:44:38
23:11:38
23:38:38
0:05:38
0:32:38
0:59:38
1:26:38
1:53:38
2:20:38
2:47:38
3:14:38
3:41:38
4:08:38
4:35:38
5:02:38
5:29:38
5:56:38
6:23:38
6:50:38
7:17:38
7:44:38
March 10 to 11, 2022

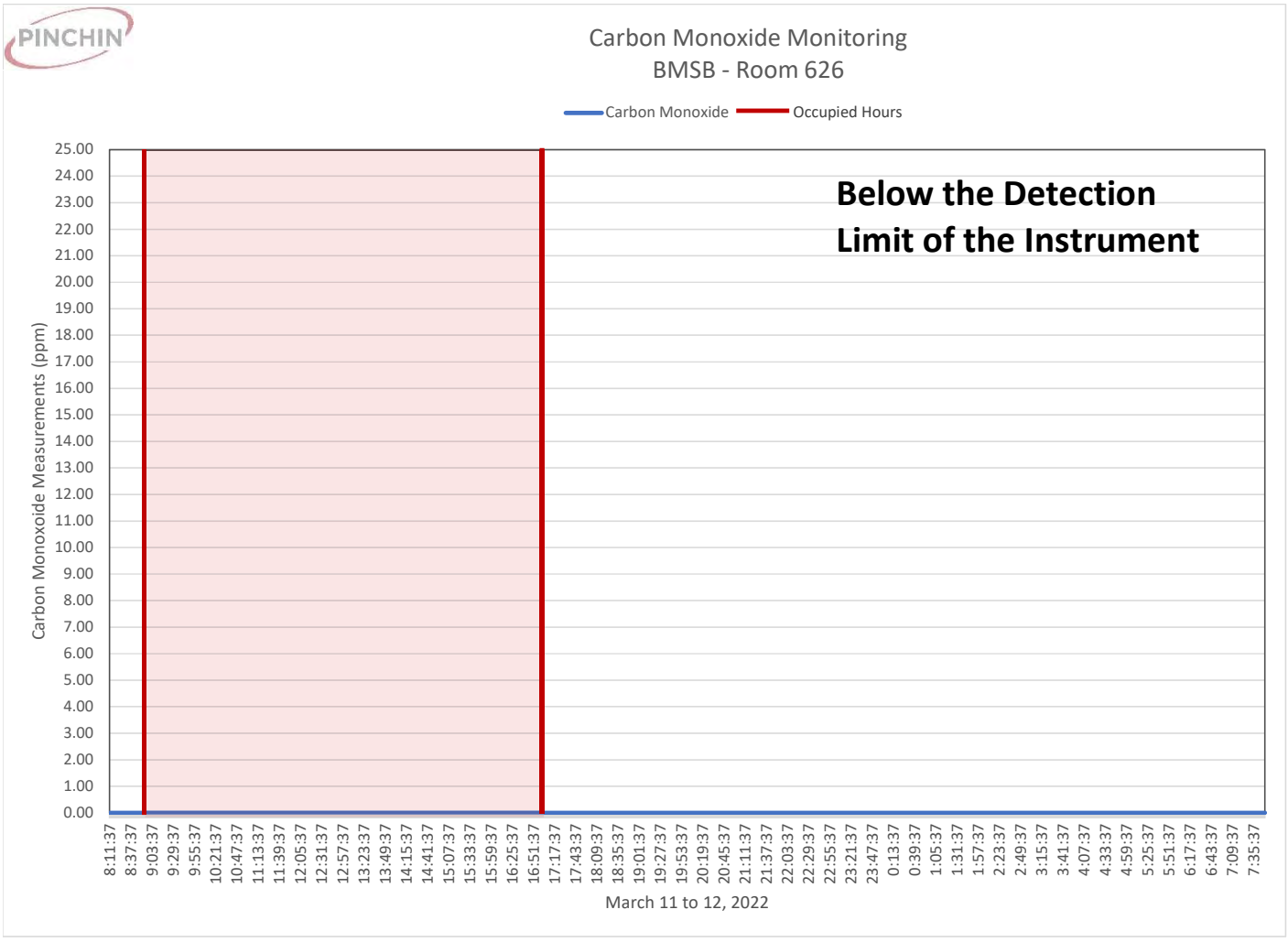

PINCHIN
Temperature Monitoring
BMSB - Room 202-206
Temperature
Occupied Hours
Temperature Measurements (°C)
50.00
47.50
45.00
42.50
40.00
37.50
35.00
32.50
30.00
27.50
25.00
22.50
20.00
17.50
15.00
12.50
10.00
7.50
5.00
2.50
0.00
7:53:38
8:20:38
8:47:38
9:14:38
9:41:38
10:08:38
10:35:38
11:02:38
11:29:38
11:56:38
12:23:38
12:50:38
13:17:38
13:44:38
14:11:38
14:38:38
15:05:38
15:32:38
15:59:38
16:26:38
16:53:38
17:20:38
17:47:38
18:14:38
18:41:38
19:08:38
19:35:38
20:02:38
20:29:38
20:56:38
21:23:38
21:50:38
22:17:38
22:44:38
23:11:38
23:38:38
0:05:38
0:32:38
0:59:38
1:26:38
1:53:38
2:20:38
2:47:38
3:14:38
3:41:38
4:08:38
4:35:38
5:02:38
5:29:38
5:56:38
6:23:38
6:50:38
7:17:38
7:44:38
March 10 to 11, 2022

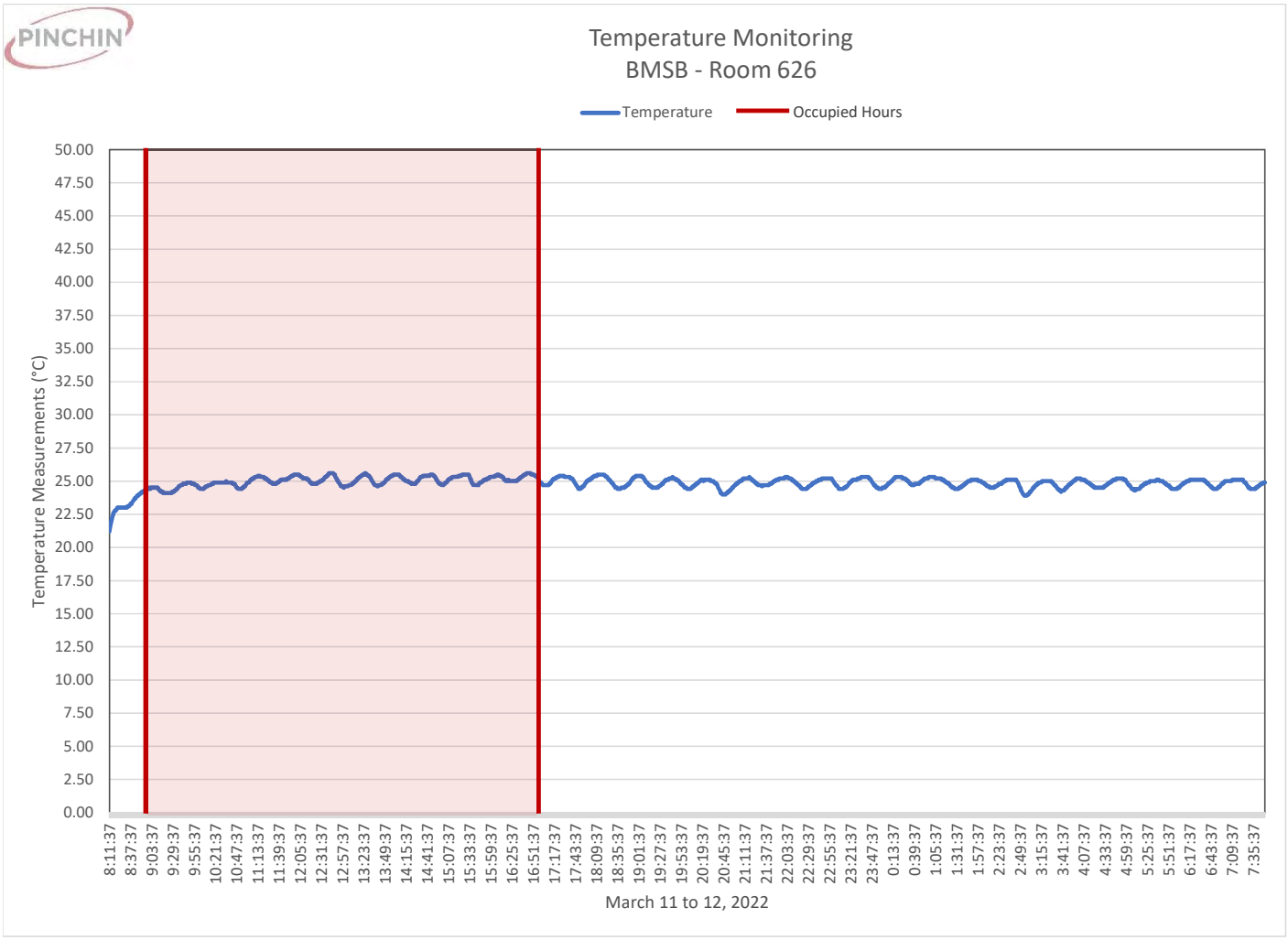

PINCHIN
Relative Humidity Monitoring
BMSB - Room 202-206
%RH
Occupied Hours
Relative Humidty Measurements (%RH)
100.00
95.00
90.00
85.00
80.00
75.00
70.00
65.00
60.00
55.00
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
7:53:38
8:20:38
8:47:38
9:14:38
9:41:38
10:08:38
10:35:38
11:02:38
11:29:38
11:56:38
12:23:38
12:50:38
13:17:38
13:44:38
14:11:38
14:38:38
15:05:38
15:32:38
15:59:38
16:26:38
16:53:38
17:20:38
17:47:38
18:14:38
18:41:38
19:08:38
19:35:38
20:02:38
20:29:38
20:56:38
21:23:38
21:50:38
22:17:38
22:44:38
23:11:38
23:38:38
0:05:38
0:32:38
0:59:38
1:26:38
1:53:38
2:20:38
2:47:38
3:14:38
3:41:38
4:08:38
4:35:38
5:02:38
5:29:38
5:56:38
6:23:38
6:50:38
7:17:38
7:44:38
March 10 to 11, 2022

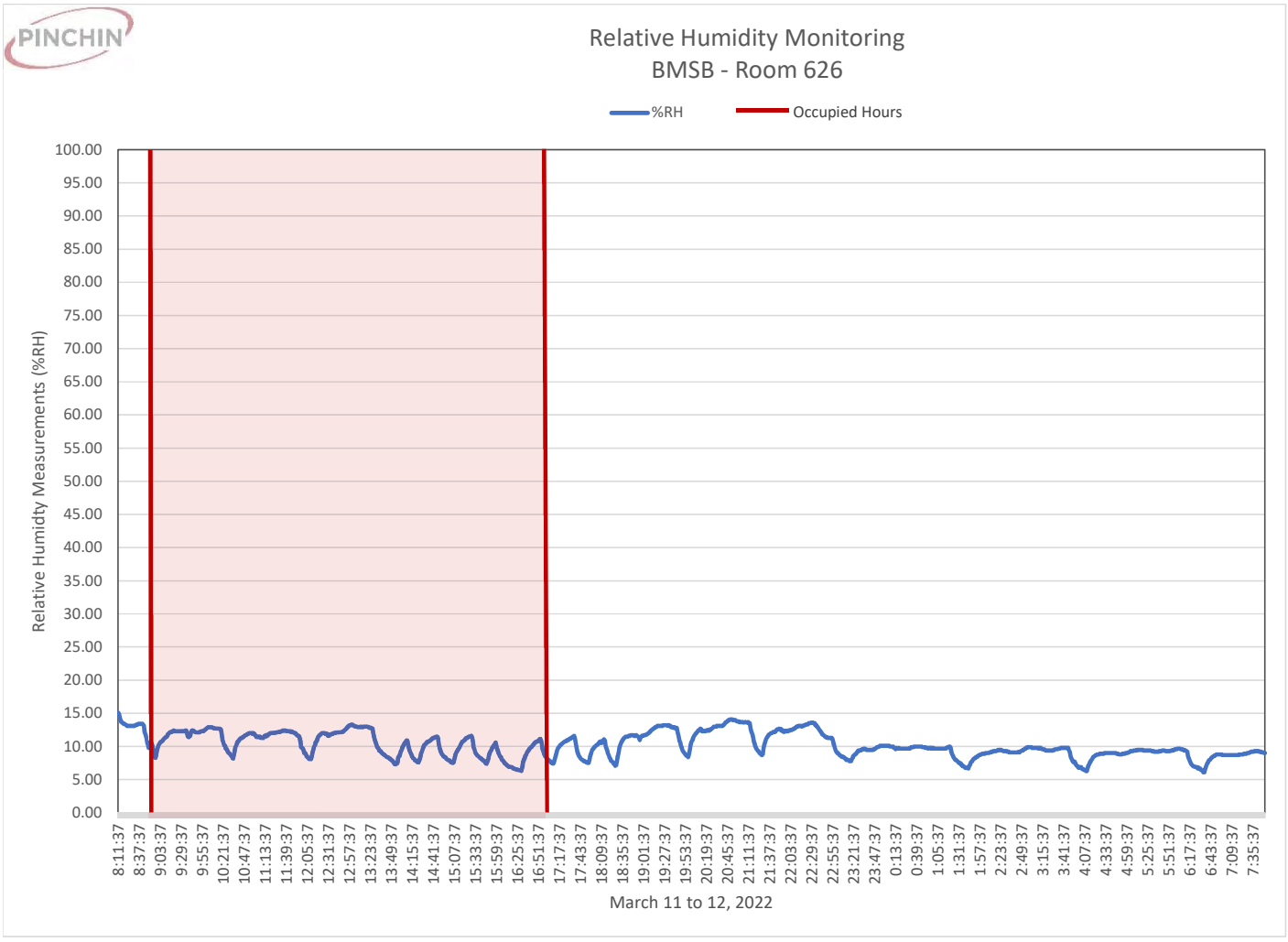

PINCHIN
Airborne Dust (PM 2.5) Monitoring
BMSB - Room 202-206
PM2.5
Occupied Hours
PM 2.5 Measurements (µg/m³)
25.00
24.00
23.00
22.00
21.00
20.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
7:53:38
8:20:38
8:47:38
9:14:38
9:41:38
10:08:38
10:35:38
11:02:38
11:29:38
11:56:38
12:23:38
12:50:38
13:17:38
13:44:38
14:11:38
14:38:38
15:05:38
15:32:38
15:59:38
16:26:38
16:53:38
17:20:38
17:47:38
18:14:38
18:41:38
19:08:38
19:35:38
20:02:38
20:29:38
20:56:38
21:23:38
21:50:38
22:17:38
22:44:38
23:11:38
23:38:38
0:05:38
0:32:38
0:59:38
1:26:38
1:53:38
2:20:38
2:47:38
3:14:38
3:41:38
4:08:38
4:35:38
5:02:38
5:29:38
5:56:38
6:23:38
6:50:38
7:17:38
7:44:38
March 10 to 11, 2022

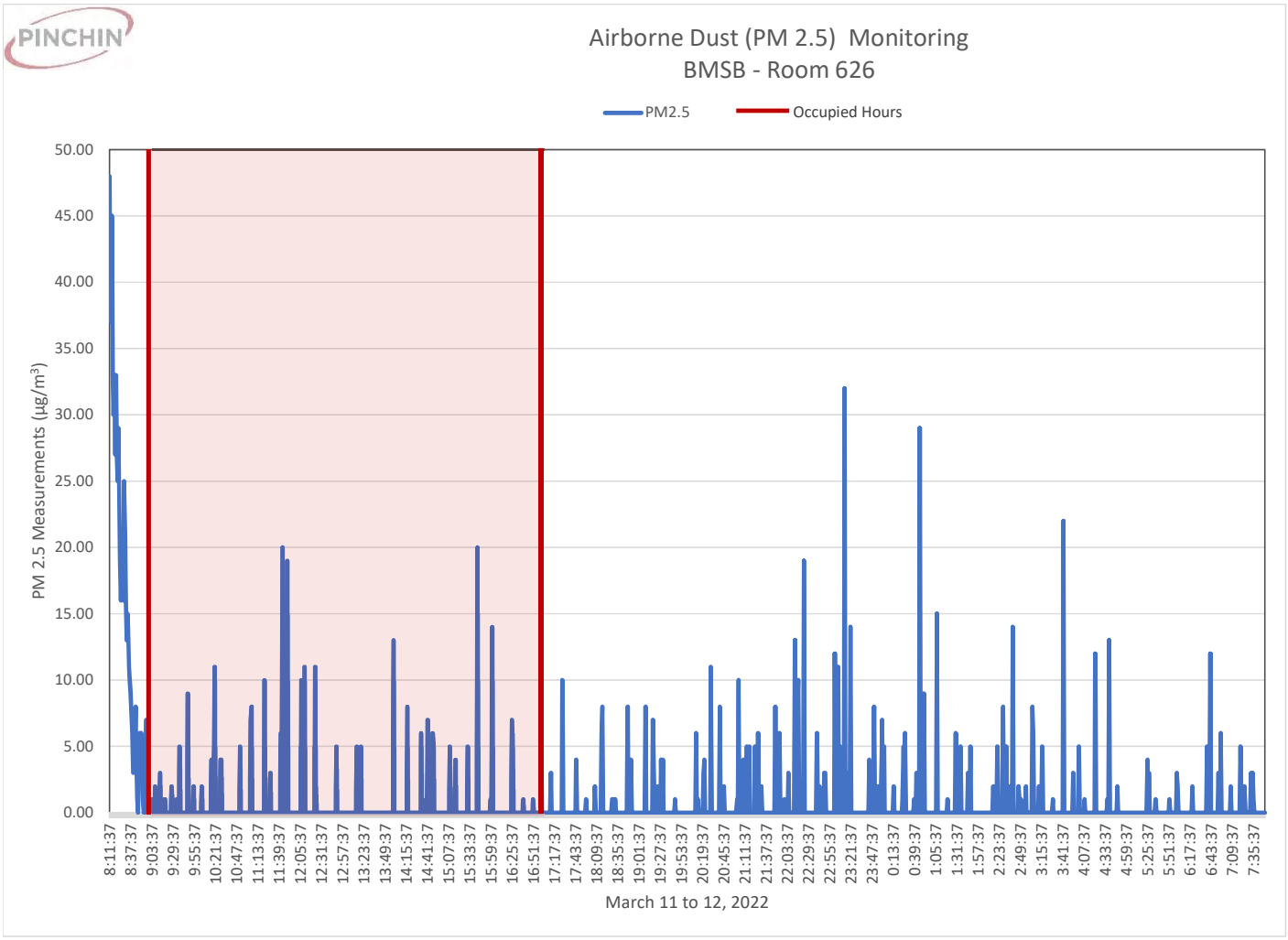

PINCHIN
TVOC Monitoring
BMSB - Room 202-206
TVOC
Occupied Hours
TVOC Measurements (PPB)
3500
3250
3000
2750
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
7:53:38
8:20:38
8:47:38
9:14:38
9:41:38
10:08:38
10:35:38
11:02:38
11:29:38
11:56:38
12:23:38
12:50:38
13:17:38
13:44:38
14:11:38
14:38:38
15:05:38
15:32:38
15:59:38
16:26:38
16:53:38
17:20:38
17:47:38
18:14:38
18:41:38
19:08:38
19:35:38
20:02:38
20:29:38
20:56:38
21:23:38
21:50:38
22:17:38
22:44:38
23:11:38
23:38:38
0:05:38
0:32:38
0:59:38
1:26:38
1:53:38
2:20:38
2:47:38
3:14:38
3:41:38
4:08:38
4:35:38
5:02:38
5:29:38
5:56:38
6:23:38
6:50:38
7:17:38
7:44:38
March 10 to 11, 2022

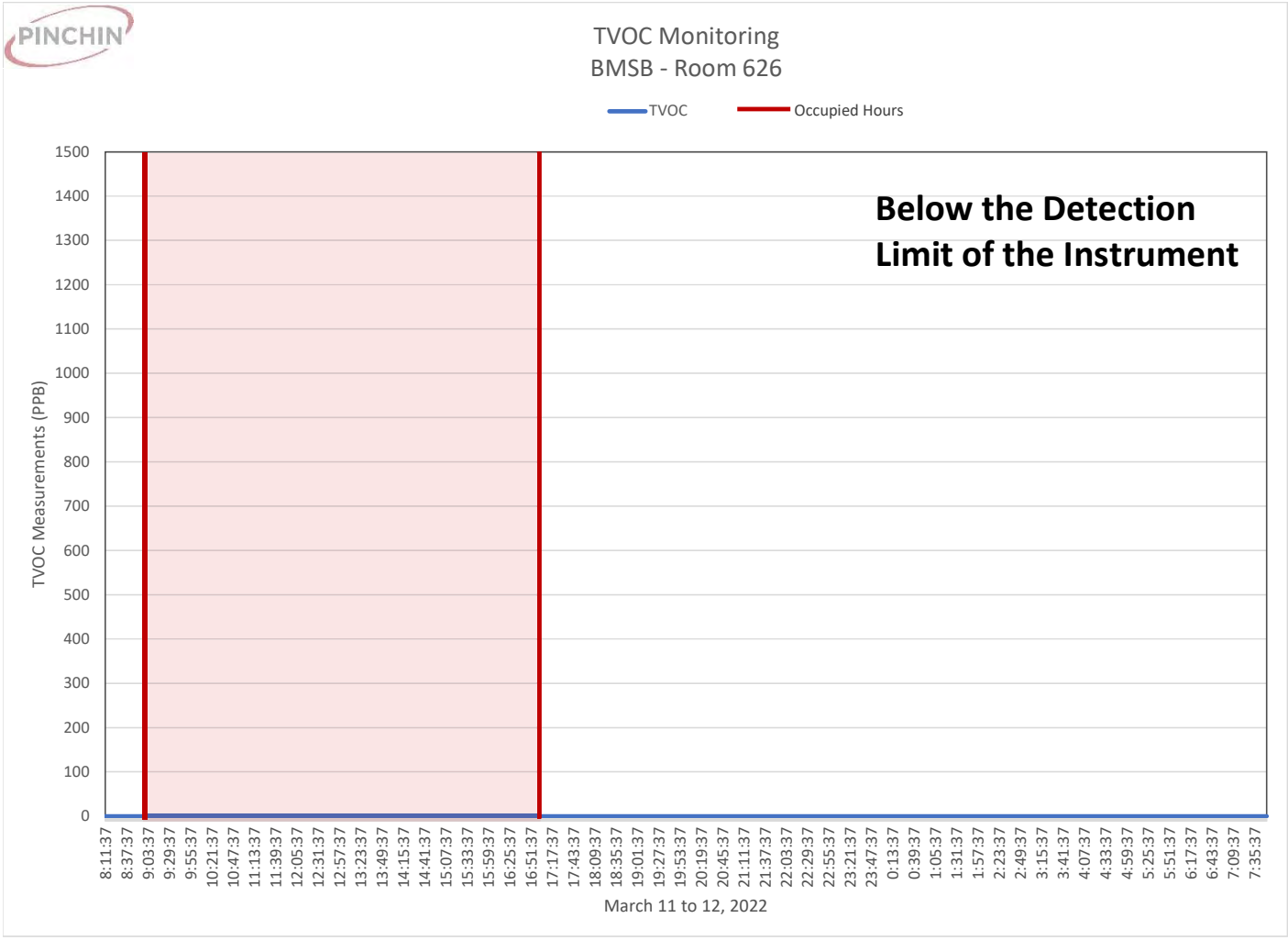

PINCHIN
Carbon Dioxide Monitoring
BMSB - Room 626
Carbon Dioxide
Occupied Hours
Carbon Dioxide Measurements (ppm)
1000.00
950.00
900.00
850.00
800.00
750.00
700.00
650.00
600.00
550.00
500.00
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
8:11:37
8:38:37
9:05:37
9:32:37
9:59:37
10:26:37
10:53:37
11:20:37
11:47:37
12:14:37
12:41:37
13:08:37
13:35:37
14:02:37
14:29:37
14:56:37
15:23:37
15:50:37
16:17:37
16:44:37
17:11:37
17:38:37
18:05:37
18:32:37
18:59:37
19:26:37
19:53:37
20:20:37
20:47:37
21:14:37
21:41:37
22:08:37
22:35:37
23:02:37
23:29:37
23:56:37
0:23:37
0:50:37
1:17:37
1:44:37
2:11:37
2:38:37
3:05:37
3:32:37
3:59:37
4:26:37
4:53:37
5:20:37
5:47:37
6:14:37
6:41:37
7:08:37
7:35:37
March 11 to 12, 2022

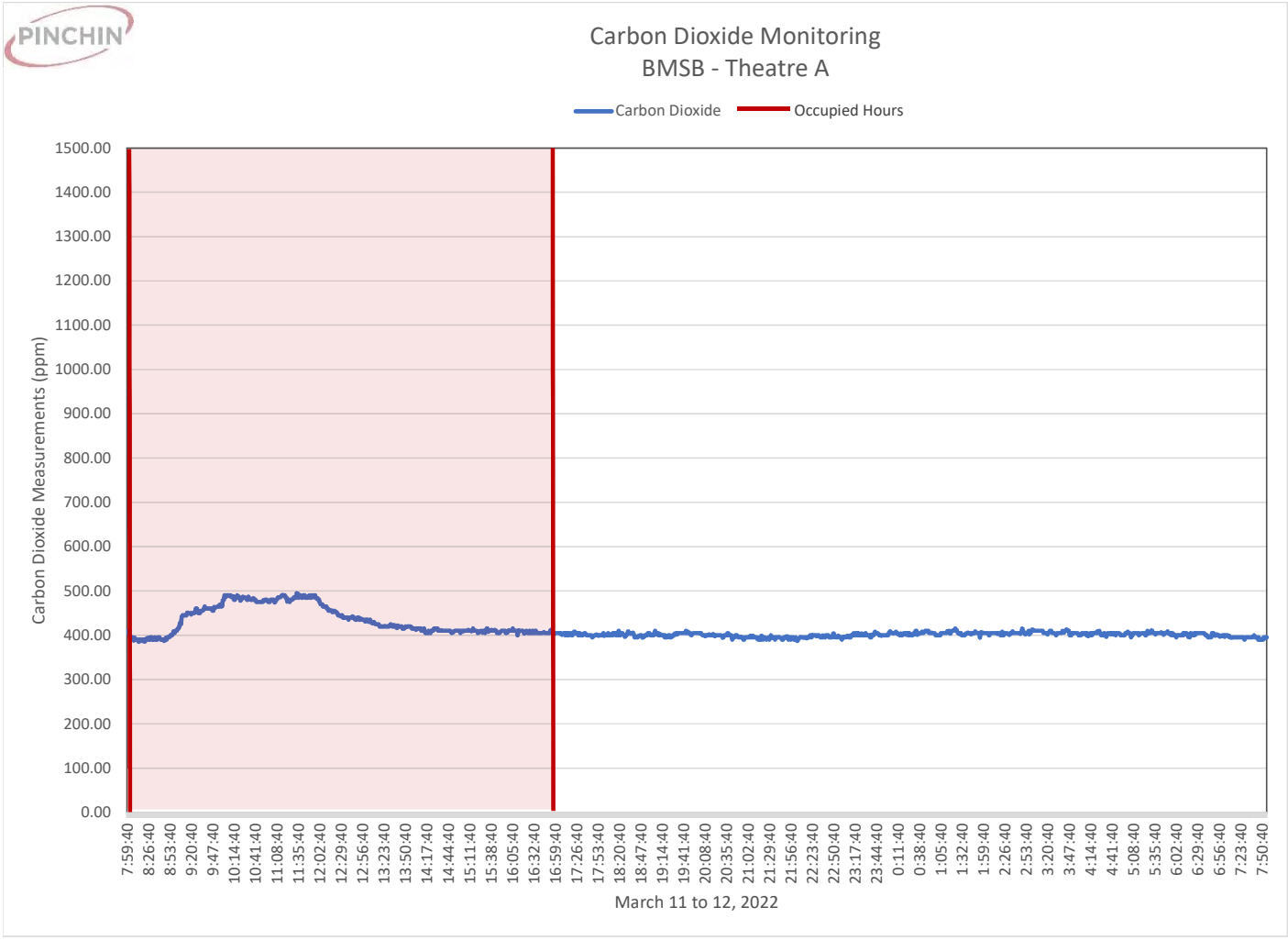

PINCHIN
Carbon Monoxide Monitoring
BMSB - Room 626
Carbon Monoxide
Occupied Hours
Below the Detection Limit of the Instrument
Carbon Monoxide Measurements (ppm)
25.00
24.00
23.00
22.00
21.00
20.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
8:11:37
8:37:37
9:03:37
9:29:37
9:55:37
10:21:37
10:47:37
11:13:37
11:39:37
12:05:37
12:31:37
12:57:37
13:23:37
13:49:37
14:15:37
14:41:37
15:07:37
15:33:37
15:59:37
16:25:37
16:51:37
17:17:37
17:43:37
18:09:37
18:35:37
19:01:37
19:27:37
19:53:37
20:19:37
20:45:37
21:11:37
21:37:37
22:03:37
22:29:37
22:55:37
23:21:37
23:47:37
0:13:37
0:39:37
1:05:37
1:31:37
1:57:37
2:23:37
2:49:37
3:15:37
3:41:37
4:07:37
4:33:37
4:59:37
5:25:37
5:51:37
6:17:37
6:43:37
7:09:37
7:35:37
March 11 to 12, 2022

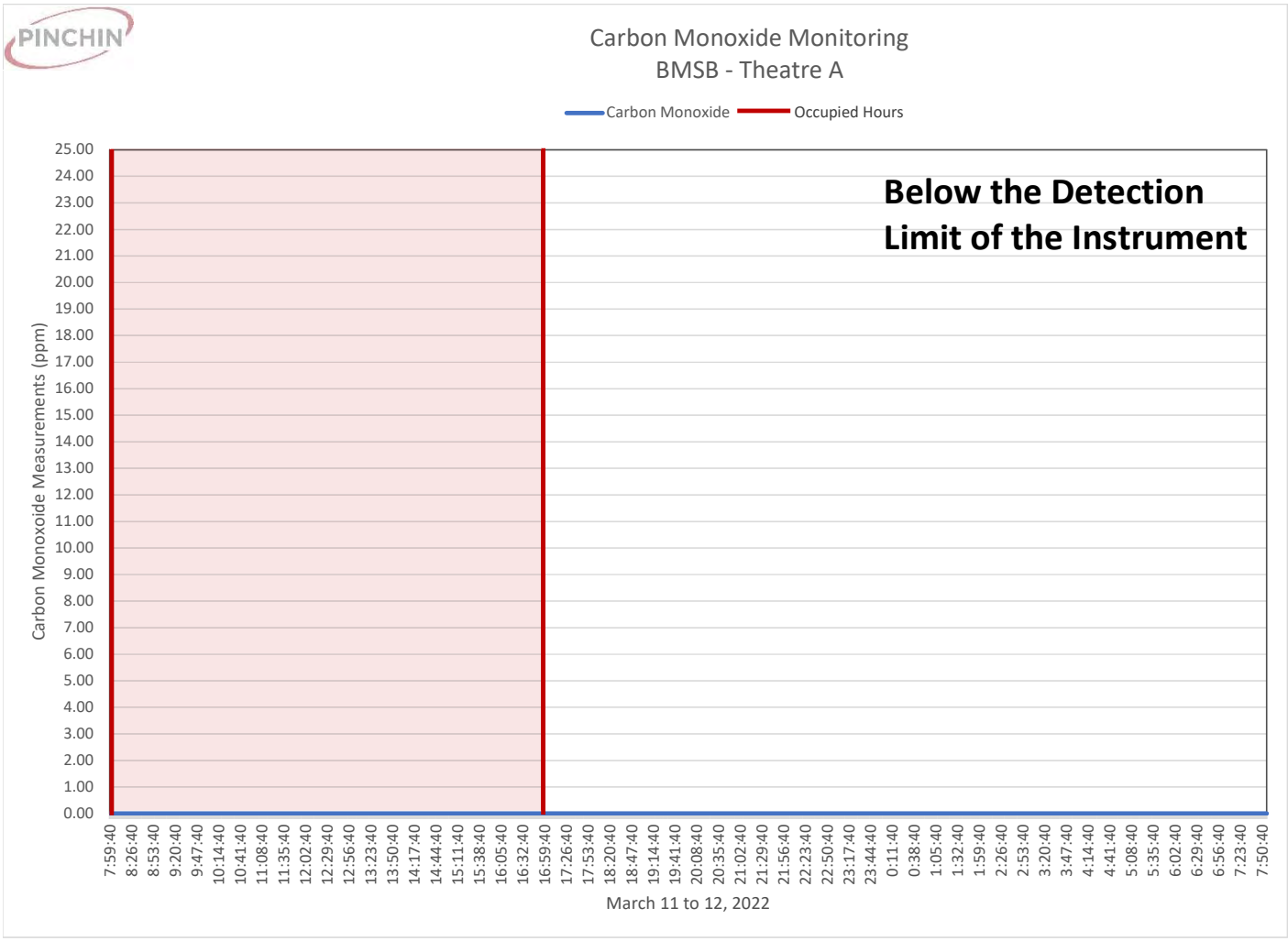

PINCHIN
Temperature Monitoring
BMSB - Room 626
Temperature
Occupied Hours
Temperature Measurements (°C)
50.00
47.50
45.00
42.50
40.00
37.50
35.00
32.50
30.00
27.50
25.00
22.50
20.00
17.50
15.00
12.50
10.00
7.50
5.00
2.50
0.00
8:11:37
8:37:37
9:03:37
9:29:37
9:55:37
10:21:37
10:47:37
11:13:37
11:39:37
12:05:37
12:31:37
12:57:37
13:23:37
13:49:37
14:15:37
14:41:37
15:07:37
15:33:37
15:59:37
16:25:37
16:51:37
17:17:37
17:43:37
18:09:37
18:35:37
19:01:37
19:27:37
19:53:37
20:19:37
20:45:37
21:11:37
21:37:37
22:03:37
22:29:37
22:55:37
23:21:37
23:47:37
0:13:37
0:39:37
1:05:37
1:31:37
1:57:37
2:23:37
2:49:37
3:15:37
3:41:37
4:07:37
4:33:37
4:59:37
5:25:37
5:51:37
6:17:37
6:43:37
7:09:37
7:35:37
March 11 to 12, 2022

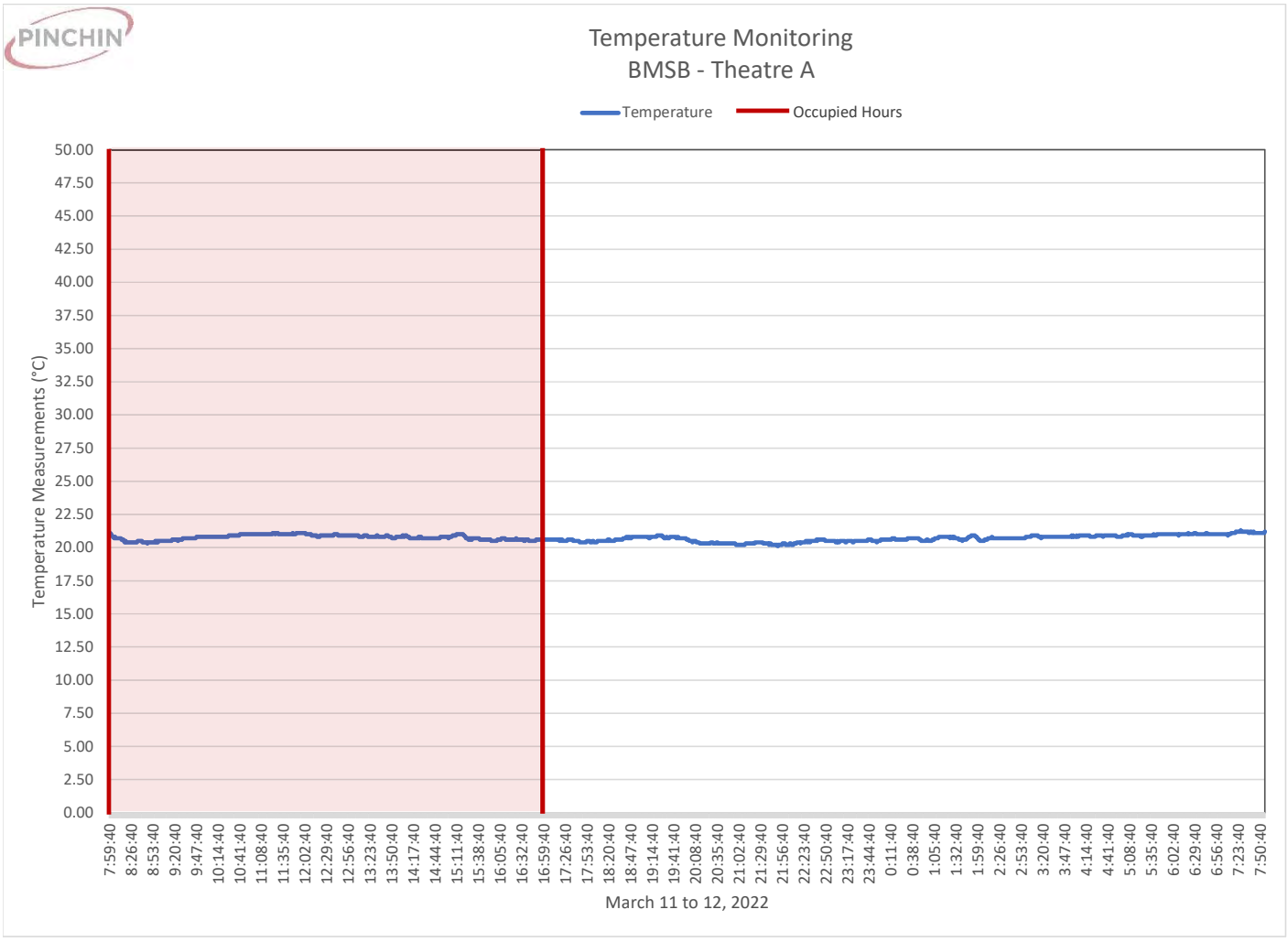

PINCHIN
Relative Humidity Monitoring
BMSB - Room 626
%RH
Occupied Hours
Relative Humidty Measurements (%RH)
100.00
95.00
90.00
85.00
80.00
75.00
70.00
65.00
60.00
55.00
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
8:11:37
8:37:37
9:03:37
9:29:37
9:55:37
10:21:37
10:47:37
11:13:37
11:39:37
12:05:37
12:31:37
12:57:37
13:23:37
13:49:37
14:15:37
14:41:37
15:07:37
15:33:37
15:59:37
16:25:37
16:51:37
17:17:37
17:43:37
18:09:37
18:35:37
19:01:37
19:27:37
19:53:37
20:19:37
20:45:37
21:11:37
21:37:37
22:03:37
22:29:37
22:55:37
23:21:37
23:47:37
0:13:37
0:39:37
1:05:37
1:31:37
1:57:37
2:23:37
2:49:37
3:15:37
3:41:37
4:07:37
4:33:37
4:59:37
5:25:37
5:51:37
6:17:37
6:43:37
7:09:37
7:35:37
March 11 to 12, 2022

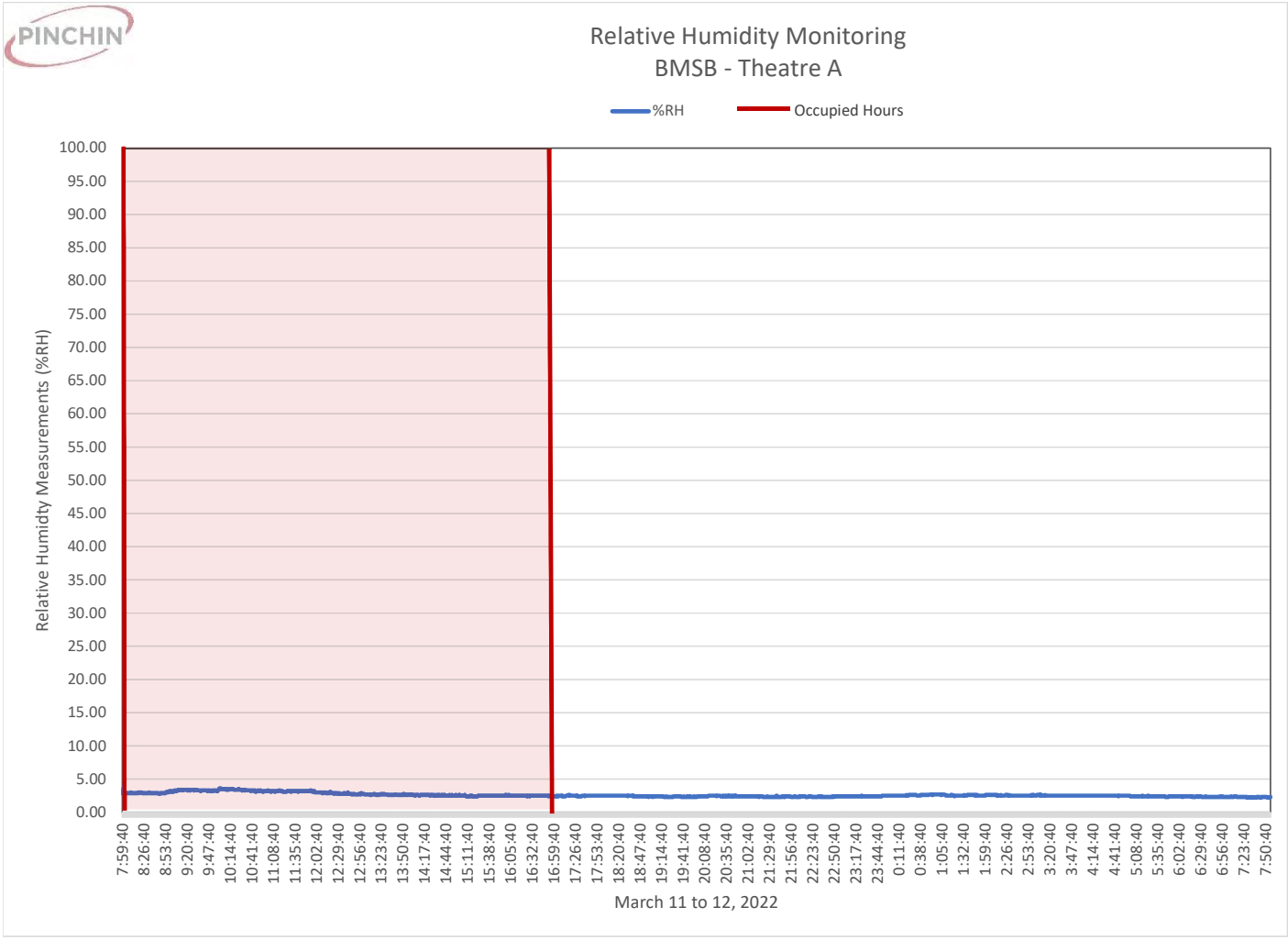

PINCHIN
Airborne Dust (PM 2.5) Monitoring
BMSB - Room 626
PM2.5
Occupied Hours
PM 2.5 Measurements (µg/m³)
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
8:11:37
8:37:37
9:03:37
9:29:37
9:55:37
10:21:37
10:47:37
11:13:37
11:39:37
12:05:37
12:31:37
12:57:37
13:23:37
13:49:37
14:15:37
14:41:37
15:07:37
15:33:37
15:59:37
16:25:37
16:51:37
17:17:37
17:43:37
18:09:37
18:35:37
19:01:37
19:27:37
19:53:37
20:19:37
20:45:37
21:11:37
21:37:37
22:03:37
22:29:37
22:55:37
23:21:37
23:47:37
0:13:37
0:39:37
1:05:37
1:31:37
1:57:37
2:23:37
2:49:37
3:15:37
3:41:37
4:07:37
4:33:37
4:59:37
5:25:37
5:51:37
6:17:37
6:43:37
7:09:37
7:35:37
March 11 to 12, 2022

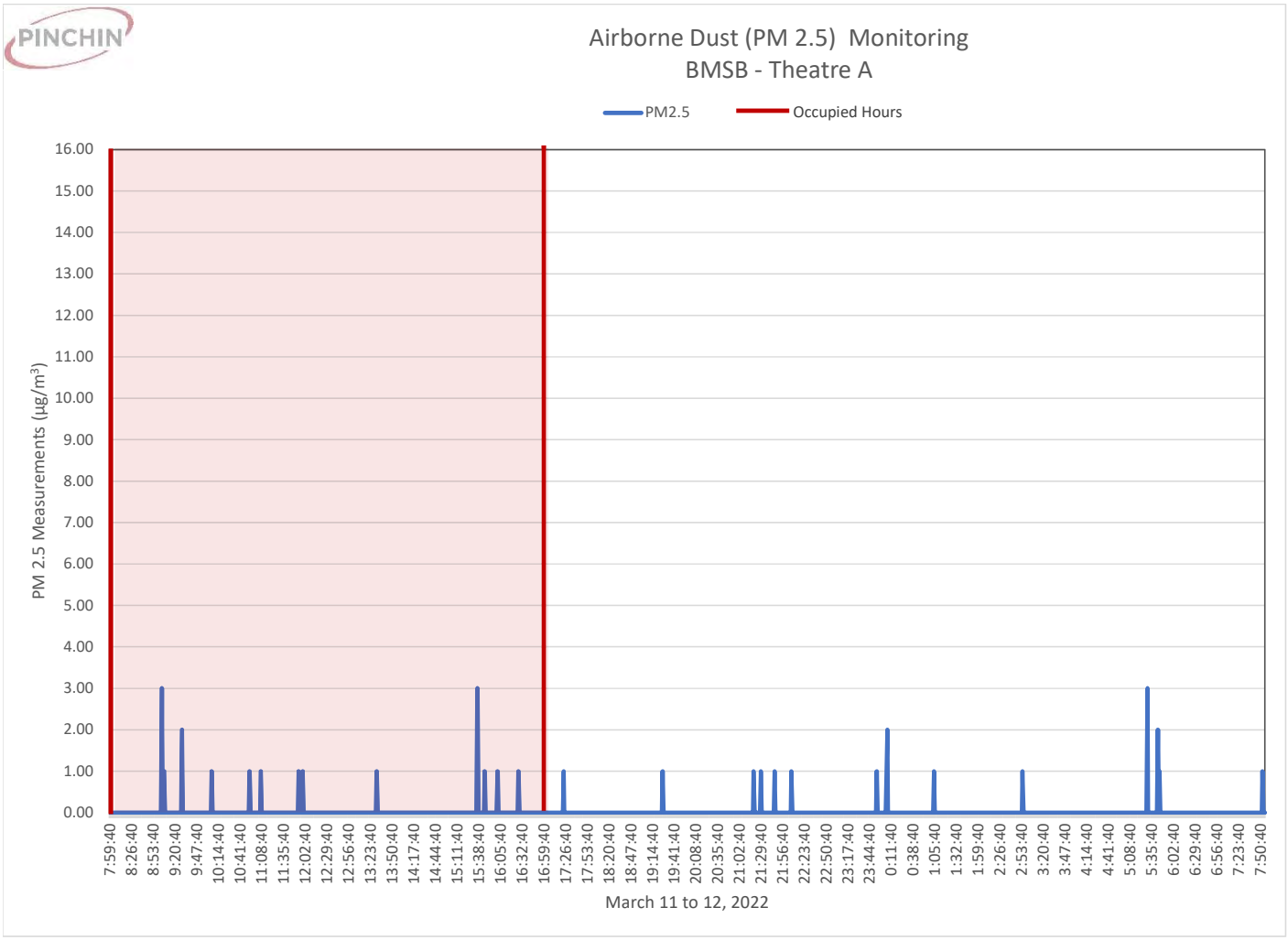

PINCHIN
TVOC Monitoring
BMSB - Room 626
TVOC
Occupied Hours
Below the Detection Limit of the Instrument
TVOC Measurements (PPB)
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
8:11:37
8:37:37
9:03:37
9:29:37
9:55:37
10:21:37
10:47:37
11:13:37
11:39:37
12:05:37
12:31:37
12:57:37
13:23:37
13:49:37
14:15:37
14:41:37
15:07:37
15:33:37
15:59:37
16:25:37
16:51:37
17:17:37
17:43:37
18:09:37
18:35:37
19:01:37
19:27:37
19:53:37
20:19:37
20:45:37
21:11:37
21:37:37
22:03:37
22:29:37
22:55:37
23:21:37
23:47:37
0:13:37
0:39:37
1:05:37
1:31:37
1:57:37
2:23:37
2:49:37
3:15:37
3:41:37
4:07:37
4:33:37
4:59:37
5:25:37
5:51:37
6:17:37
6:43:37
7:09:37
7:35:37
March 11 to 12, 2022

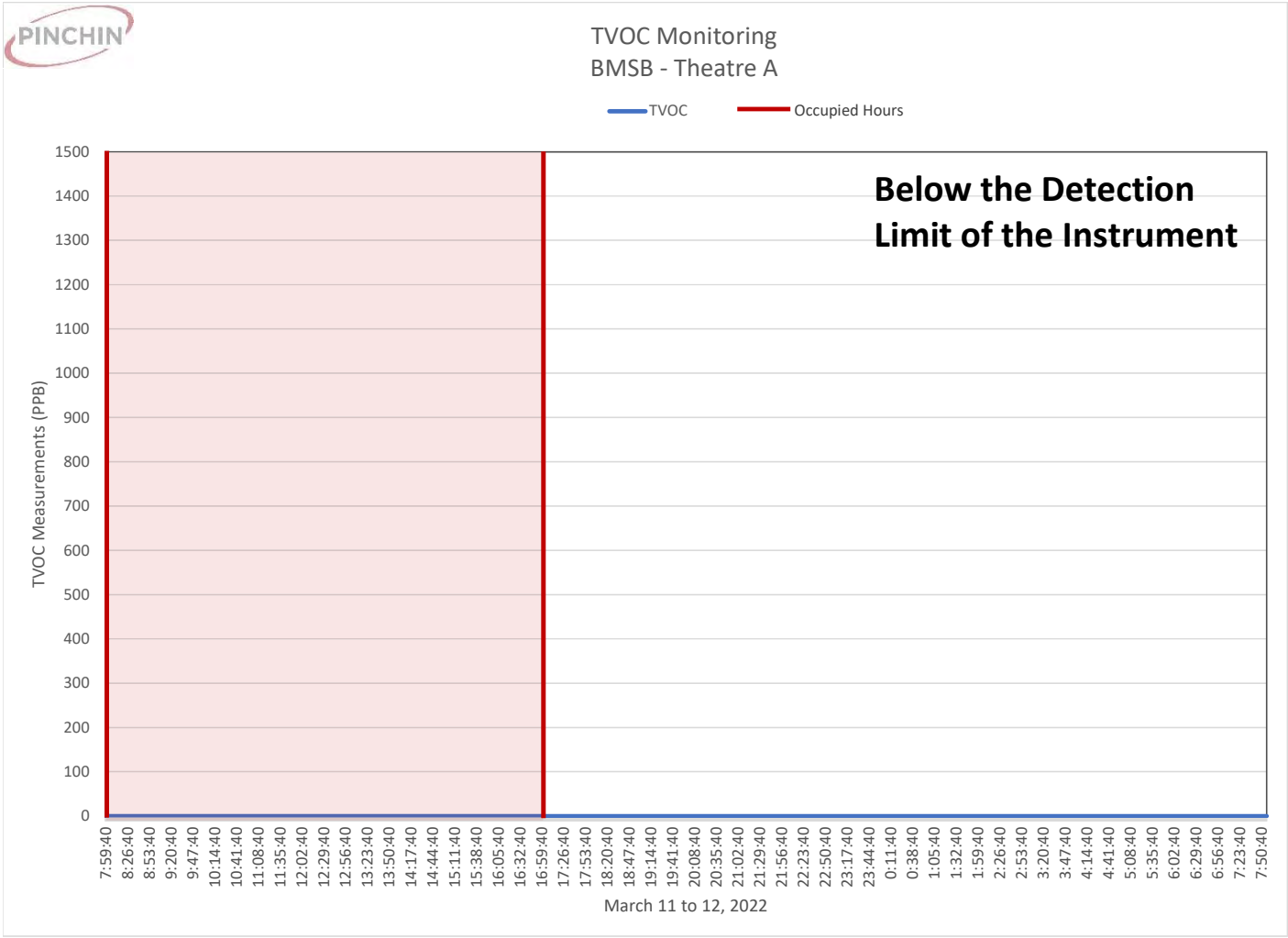

PINCHIN
Carbon Dioxide Monitoring
BMSB - Theatre A
Carbon Dioxide
Occupied Hours
Carbon Dioxide Measurements (ppm)
1500.00
1400.00
1300.00
1200.00
1100.00
1000.00
900.00
800.00
700.00
600.00
500.00
400.00
300.00
200.00
100.00
0.00
7:59:40
8:26:40
8:53:40
9:20:40
9:47:40
10:14:40
10:41:40
11:08:40
11:35:40
12:02:40
12:29:40
12:56:40
13:23:40
13:50:40
14:17:40
14:44:40
15:11:40
15:38:40
16:05:40
16:32:40
16:59:40
17:26:40
17:53:40
18:20:40
18:47:40
19:14:40
19:41:40
20:08:40
20:35:40
21:02:40
21:29:40
21:56:40
22:23:40
22:50:40
23:17:40
23:44:40
0:11:40
0:38:40
1:05:40
1:32:40
1:59:40
2:26:40
2:53:40
3:20:40
3:47:40
4:14:40
4:41:40
5:08:40
5:35:40
6:02:40
6:29:40
6:56:40
7:23:40
7:50:40
March 11 to 12, 2022

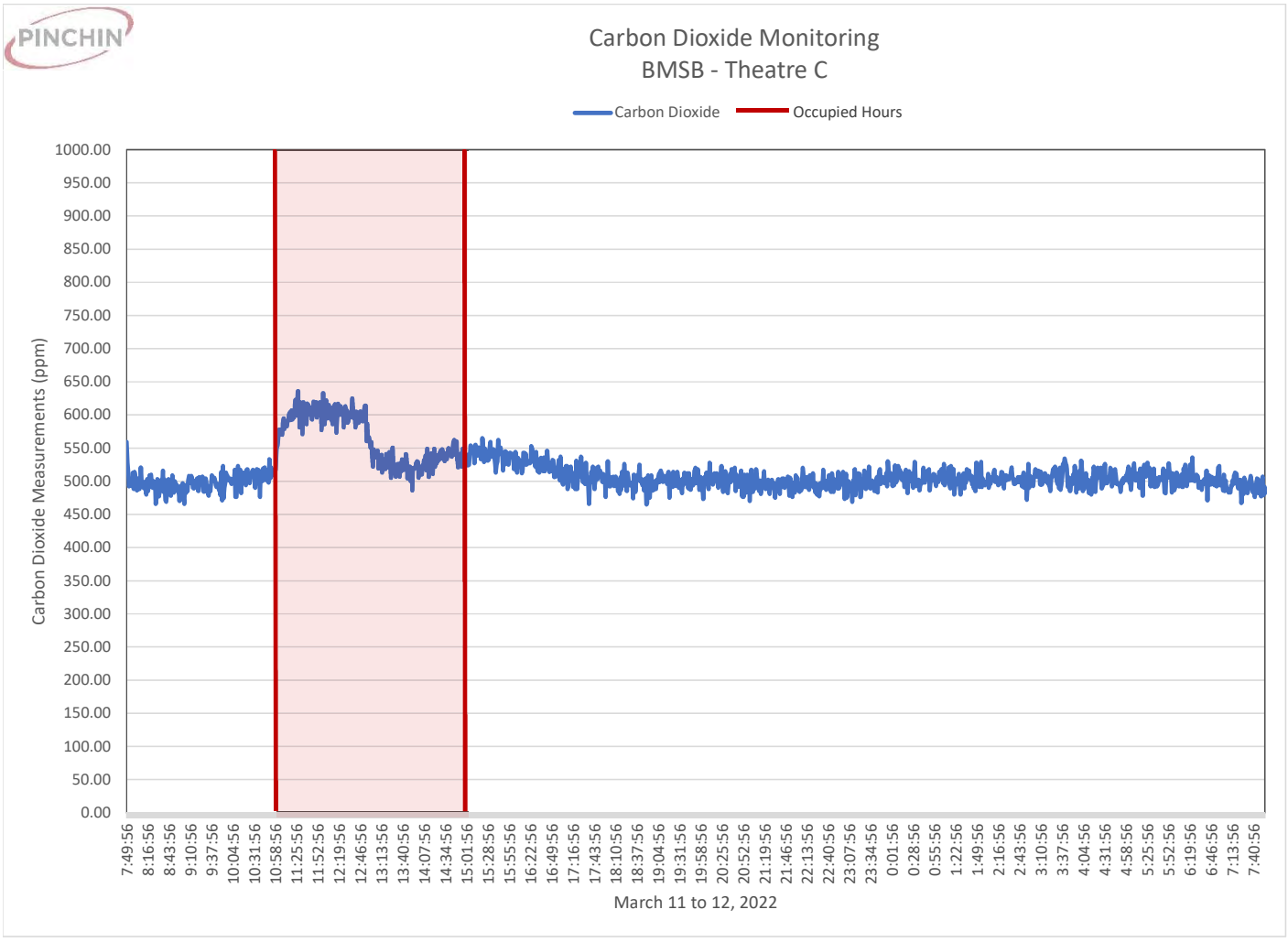

PINCHIN
Carbon Monoxide Monitoring
BMSB - Theatre A
Carbon Monoxide
Occupied Hours
Below the Detection Limit of the Instrument
Carbon Monoxide Measurements (ppm)
25.00
24.00
23.00
22.00
21.00
20.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
7:59:40
8:26:40
8:53:40
9:20:40
9:47:40
10:14:40
10:41:40
11:08:40
11:35:40
12:02:40
12:29:40
12:56:40
13:23:40
13:50:40
14:17:40
14:44:40
15:11:40
15:38:40
16:05:40
16:32:40
16:59:40
17:26:40
17:53:40
18:20:40
18:47:40
19:14:40
19:41:40
20:08:40
20:35:40
21:02:40
21:29:40
21:56:40
22:23:40
22:50:40
23:17:40
23:44:40
0:11:40
0:38:40
1:05:40
1:32:40
1:59:40
2:26:40
2:53:40
3:20:40
3:47:40
4:14:40
4:41:40
5:08:40
5:35:40
6:02:40
6:29:40
6:56:40
7:23:40
7:50:40
March 11 to 12, 2022

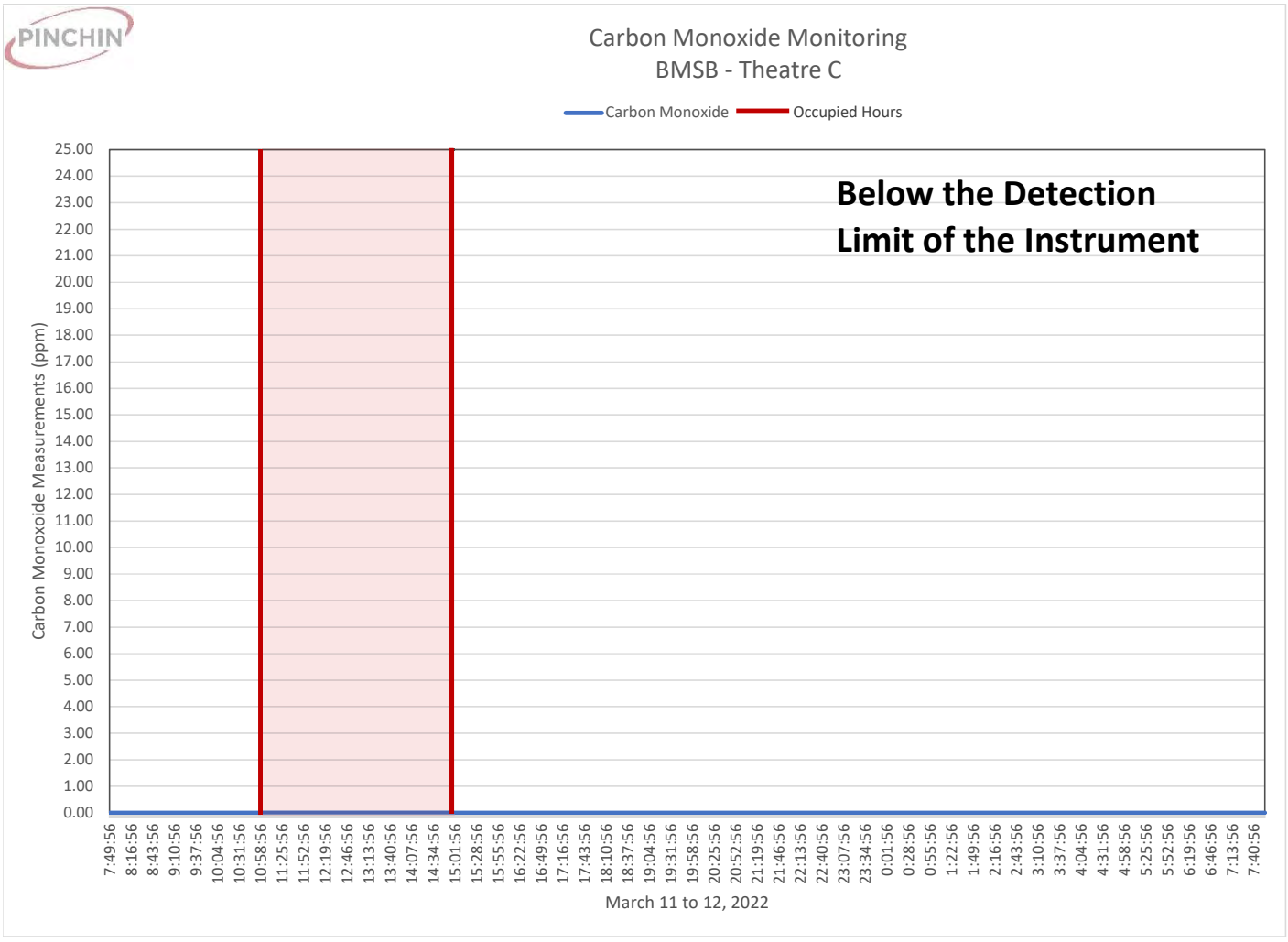

PINCHIN
Temperature Monitoring
BMSB - Theatre A
Temperature
Occupied Hours
Temperature Measurements (°C)
50.00
47.50
45.00
42.50
40.00
37.50
35.00
32.50
30.00
27.50
25.00
22.50
20.00
17.50
15.00
12.50
10.00
7.50
5.00
2.50
0.00
7:59:40
8:26:40
8:53:40
9:20:40
9:47:40
10:14:40
10:41:40
11:08:40
11:35:40
12:02:40
12:29:40
12:56:40
13:23:40
13:50:40
14:17:40
14:44:40
15:11:40
15:38:40
16:05:40
16:32:40
16:59:40
17:26:40
17:53:40
18:20:40
18:47:40
19:14:40
19:41:40
20:08:40
20:35:40
21:02:40
21:29:40
21:56:40
22:23:40
22:50:40
23:17:40
23:44:40
0:11:40
0:38:40
1:05:40
1:32:40
1:59:40
2:26:40
2:53:40
3:20:40
3:47:40
4:14:40
4:41:40
5:08:40
5:35:40
6:02:40
6:29:40
6:56:40
7:23:40
7:50:40
March 11 to 12, 2022

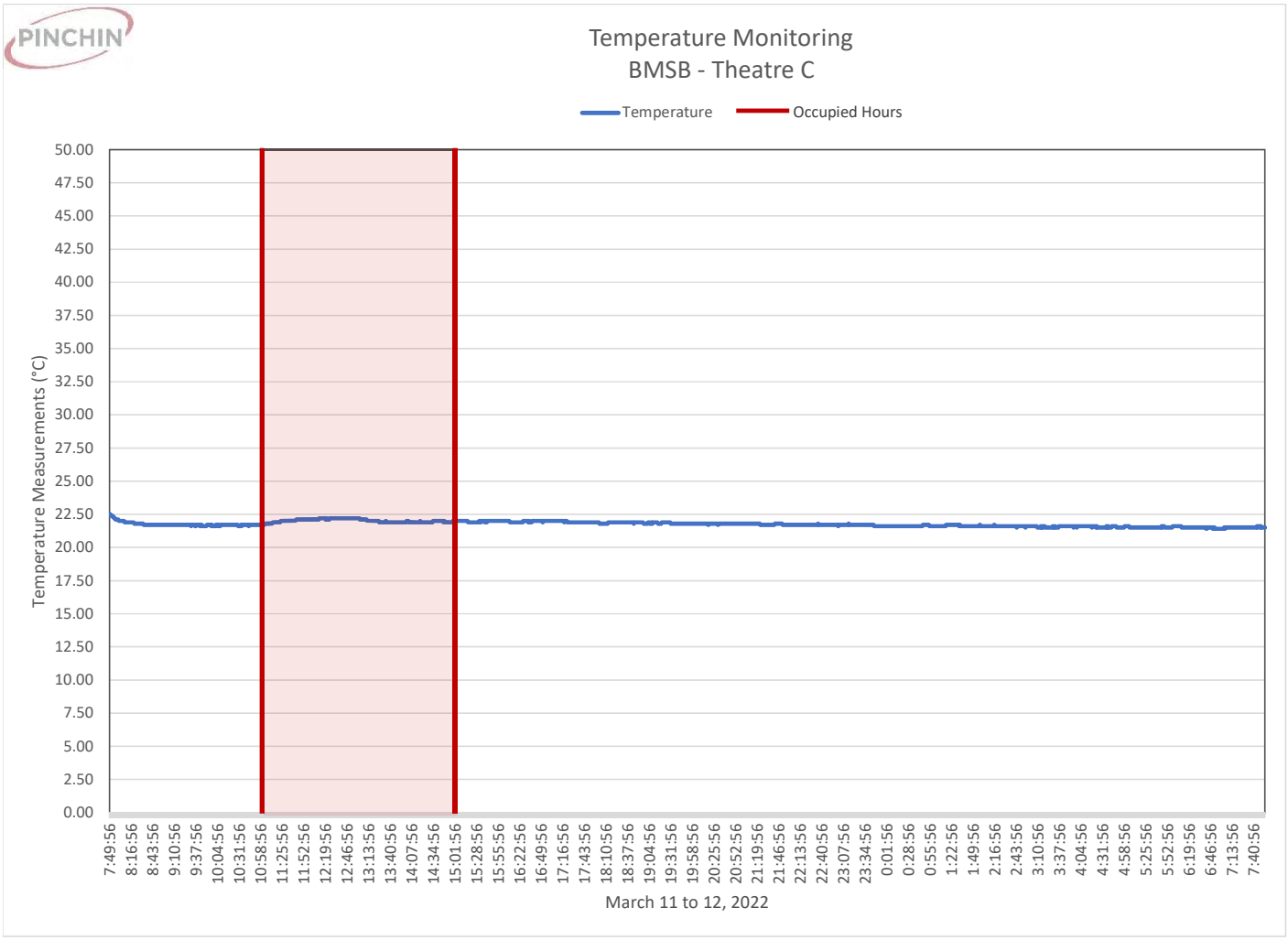

PINCHIN
Relative Humidity Monitoring
BMSB - Theatre A
%RH
Occupied Hours
Relative Humidty Measurements (%RH)
100.00
95.00
90.00
85.00
80.00
75.00
70.00
65.00
60.00
55.00
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
7:59:40
8:26:40
8:53:40
9:20:40
9:47:40
10:14:40
10:41:40
11:08:40
11:35:40
12:02:40
12:29:40
12:56:40
13:23:40
13:50:40
14:17:40
14:44:40
15:11:40
15:38:40
16:05:40
16:32:40
16:59:40
17:26:40
17:53:40
18:20:40
18:47:40
19:14:40
19:41:40
20:08:40
20:35:40
21:02:40
21:29:40
21:56:40
22:23:40
22:50:40
23:17:40
23:44:40
0:11:40
0:38:40
1:05:40
1:32:40
1:59:40
2:26:40
2:53:40
3:20:40
3:47:40
4:14:40
4:41:40
5:08:40
5:35:40
6:02:40
6:29:40
6:56:40
7:23:40
7:50:40
March 11 to 12, 2022


PINCHIN
Airborne Dust (PM 2.5) Monitoring
BMSB - Theatre A
PM2.5
Occupied Hours
PM 2.5 Measurements (µg/m³)
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
7:59:40
8:26:40
8:53:40
9:20:40
9:47:40
10:14:40
10:41:40
11:08:40
11:35:40
12:02:40
12:29:40
12:56:40
13:23:40
13:50:40
14:17:40
14:44:40
15:11:40
15:38:40
16:05:40
16:32:40
16:59:40
17:26:40
17:53:40
18:20:40
18:47:40
19:14:40
19:41:40
20:08:40
20:35:40
21:02:40
21:29:40
21:56:40
22:23:40
22:50:40
23:17:40
23:44:40
0:11:40
0:38:40
1:05:40
1:32:40
1:59:40
2:26:40
2:53:40
3:20:40
3:47:40
4:14:40
4:41:40
5:08:40
5:35:40
6:02:40
6:29:40
6:56:40
7:23:40
7:50:40
March 11 to 12, 2022


PINCHIN
TVOC Monitoring
BMSB - Theatre A
TVOC
Occupied Hours
Below the Detection Limit of the Instrument
TVOC Measurements (PPB)
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
7:59:40
8:26:40
8:53:40
9:20:40
9:47:40
10:14:40
10:41:40
11:08:40
11:35:40
12:02:40
12:29:40
12:56:40
13:23:40
13:50:40
14:17:40
14:44:40
15:11:40
15:38:40
16:05:40
16:32:40
16:59:40
17:26:40
17:53:40
18:20:40
18:47:40
19:14:40
19:41:40
20:08:40
20:35:40
21:02:40
21:29:40
21:56:40
22:23:40
22:50:40
23:17:40
23:44:40
0:11:40
0:38:40
1:05:40
1:32:40
1:59:40
2:26:40
2:53:40
3:20:40
3:47:40
4:14:40
4:41:40
5:08:40
5:35:40
6:02:40
6:29:40
6:56:40
7:23:40
7:50:40
March 11 to 12, 2022


PINCHIN
Carbon Dioxide Monitoring
BMSB - Theatre C
Carbon Dioxide
Occupied Hours
Carbon Dioxide Measurements (ppm)
1000.00
950.00
900.00
850.00
800.00
750.00
700.00
650.00
600.00
550.00
500.00
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
7:49:56
8:16:56
8:43:56
9:10:56
9:37:56
10:04:56
10:31:56
10:58:56
11:25:56
11:52:56
12:19:56
12:46:56
13:13:56
13:40:56
14:07:56
14:34:56
15:01:56
15:28:56
15:55:56
16:22:56
16:49:56
17:16:56
17:43:56
18:10:56
18:37:56
19:04:56
19:31:56
19:58:56
20:25:56
20:52:56
21:19:56
21:46:56
22:13:56
22:40:56
23:07:56
23:34:56
0:01:56
0:28:56
0:55:56
1:22:56
1:49:56
2:16:56
2:43:56
3:10:56
3:37:56
4:04:56
4:31:56
4:58:56
5:25:56
5:52:56
6:19:56
6:46:56
7:13:56
7:40:56
March 11 to 12, 2022


PINCHIN
Carbon Monoxide Monitoring
BMSB - Theatre C
Carbon Monoxide
Occupied Hours
Below the Detection Limit of the Instrument
Carbon Monoxide Measurements (ppm)
25.00
24.00
23.00
22.00
21.00
20.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
7:49:56
8:16:56
8:43:56
9:10:56
9:37:56
10:04:56
10:31:56
10:58:56
11:25:56
11:52:56
12:19:56
12:46:56
13:13:56
13:40:56
14:07:56
14:34:56
15:01:56
15:28:56
15:55:56
16:22:56
16:49:56
17:16:56
17:43:56
18:10:56
18:37:56
19:04:56
19:31:56
19:58:56
20:25:56
20:52:56
21:19:56
21:46:56
22:13:56
22:40:56
23:07:56
23:34:56
0:01:56
0:28:56
0:55:56
1:22:56
1:49:56
2:16:56
2:43:56
3:10:56
3:37:56
4:04:56
4:31:56
4:58:56
5:25:56
5:52:56
6:19:56
6:46:56
7:13:56
7:40:56
March 11 to 12, 2022


PINCHIN
Temperature Monitoring
BMSB - Theatre C
Temperature
Occupied Hours
Temperature Measurements (°C)
50.00
47.50
45.00
42.50
40.00
37.50
35.00
32.50
30.00
27.50
25.00
22.50
20.00
17.50
15.00
12.50
10.00
7.50
5.00
2.50
0.00
7:49:56
8:16:56
8:43:56
9:10:56
9:37:56
10:04:56
10:31:56
10:58:56
11:25:56
11:52:56
12:19:56
12:46:56
13:13:56
13:40:56
14:07:56
14:34:56
15:01:56
15:28:56
15:55:56
16:22:56
16:49:56
17:16:56
17:43:56
18:10:56
18:37:56
19:04:56
19:31:56
19:58:56
20:25:56
20:52:56
21:19:56
21:46:56
22:13:56
22:40:56
23:07:56
23:34:56
0:01:56
0:28:56
0:55:56
1:22:56
1:49:56
2:16:56
2:43:56
3:10:56
3:37:56
4:04:56
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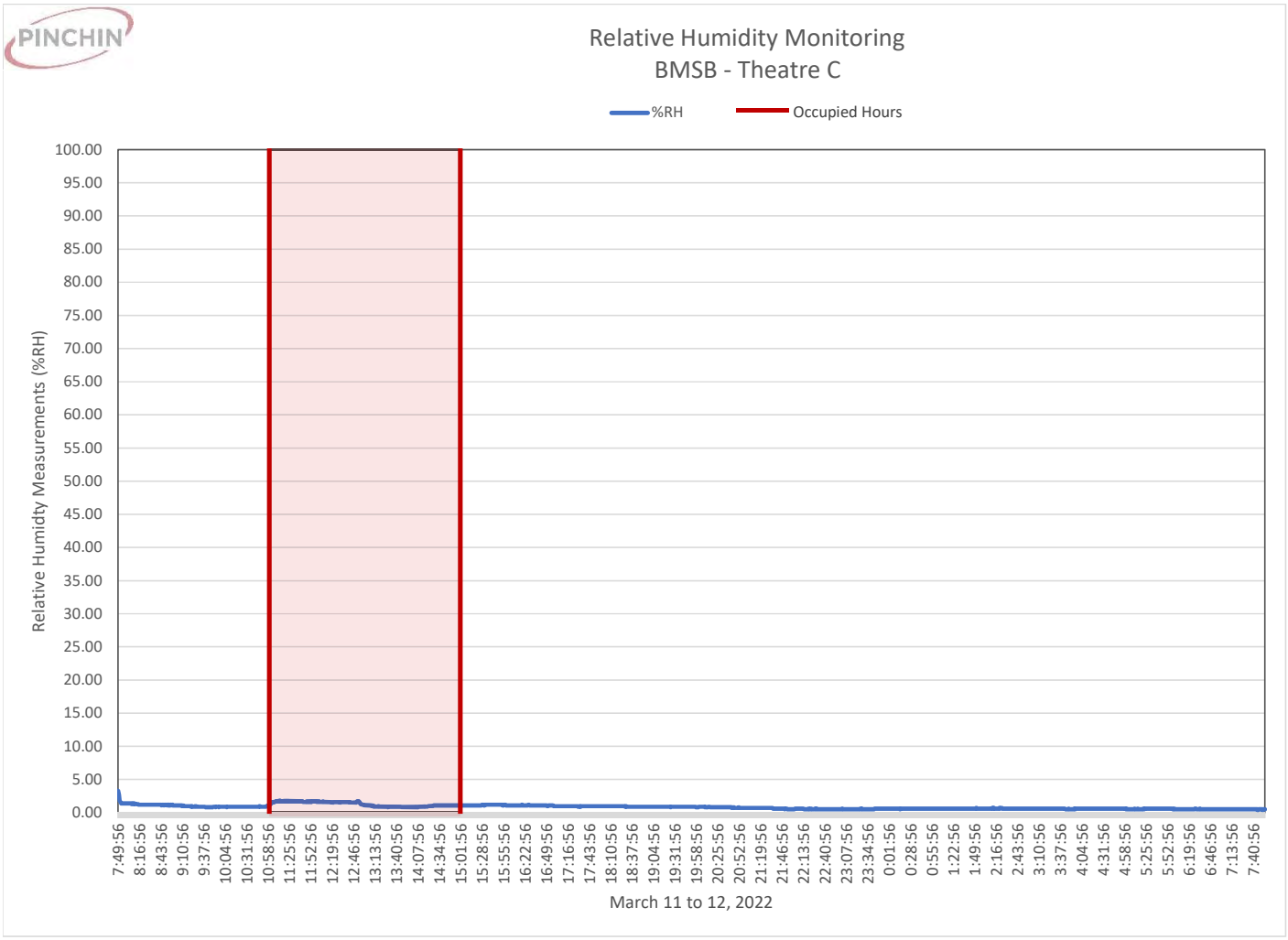
March 11 to 12, 2022


PINCHIN
Relative Humidity Monitoring
BMSB - Theatre C
%RH
Occupied Hours
Relative Humidty Measurements (%RH)
100.00
95.00
90.00
85.00
80.00
75.00
70.00
65.00
60.00
55.00
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
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10:58:56
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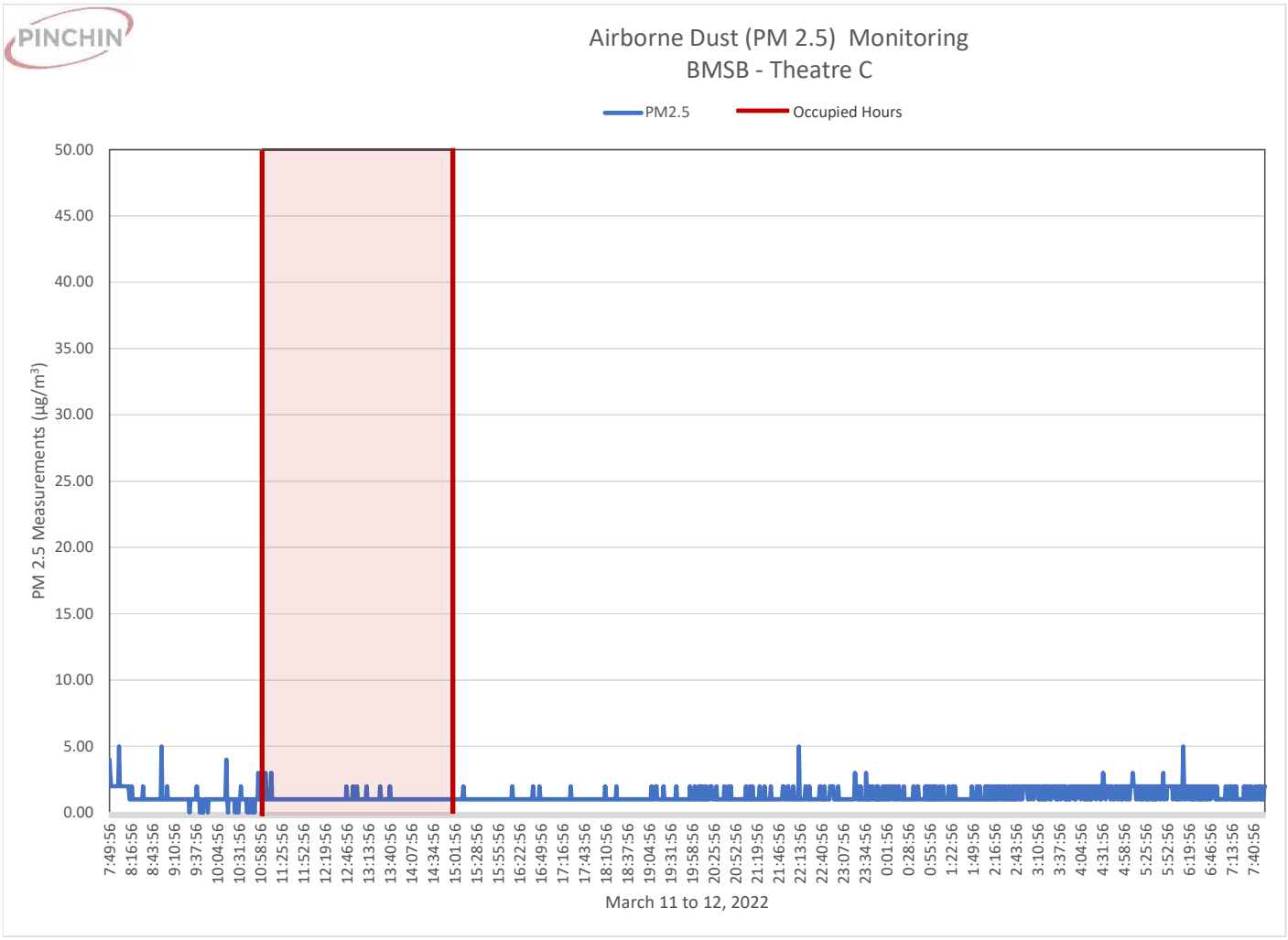
7:40:56
March 11 to 12, 2022


PINCHIN
Airborne Dust (PM 2.5) Monitoring
BMSB - Theatre C
PM2.5
Occupied Hours
PM 2.5 Measurements (µg/m³)
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
7:49:56
8:16:56
8:43:56
9:10:56
9:37:56
10:04:56
10:31:56
10:58:56
11:25:56
11:52:56
12:19:56
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13:13:56
13:40:56
14:07:56
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2:16:56
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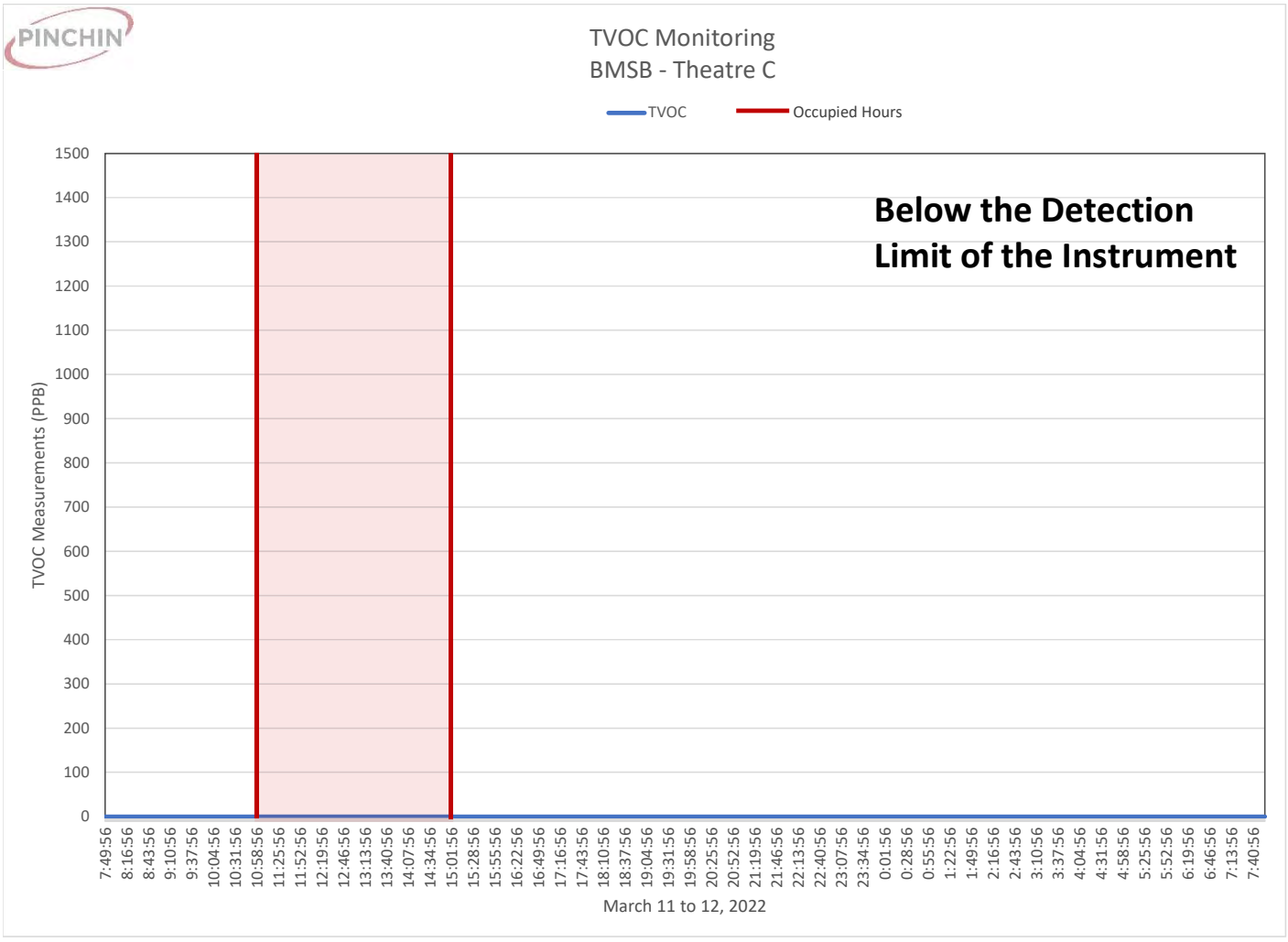
7:40:56
March 11 to 12, 2022


PINCHIN
TVOC Monitoring
BMSB - Theatre C
TVOC
Occupied Hours
Below the Detection Limit of the Instrument
TVOC Measurements (PPB)
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
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8:43:56
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7:13:56
7:40:56
March 11 to 12, 2022

FINAL

Investigation of Indoor Air Quality

Chown Building
753 McDermot Avenue, Winnipeg, Manitoba

Prepared for:

University of Manitoba
120 Physical Plant, 89 Freedman Crescent
Winnipeg, Manitoba R3T 2N2

April 13, 2022

Pinchin File: 306866

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EXECUTIVE SUMMARY

Pinchin Ltd. (Pinchin) was retained by University of Manitoba (the Client) to conduct an investigation of Indoor Air Quality (IAQ) that included 24-hour monitoring. The work was conducted at 753 McDermot Avenue, Winnipeg, Manitoba. Room A106 of the Chown Building was the data logging location chosen by the client as it was occupied by staff and students during the hours of 13:00-17:00. Room A106 is located on the 1st floor of the Chown Building at the Bannatyne campus. The client also requested that in this location observations be made specifically regarding the cleanliness of supply air diffusers and return air grilles.

Along with the 24 hour monitoring in Room A106 the client requested an inspection of the Heating Ventilation Air Conditioning (HVAC) system to determine if there were conditions present that could degrade air quality, i.e., dirty or wrongly fitted filters, presence of moisture, etc..

The majority of the indoor air quality measurements collected were within recommended ranges and meet the criteria of the referenced guidelines. Carbon dioxide concentrations suggested adequate ventilation. Carbon monoxide concentrations did not suggest the presence of exhaust or combustion gases. Temperature measurements were within the recommended comfort ranges for office environments. $PM_{2.5}$ concentrations were within typical ranges. Total Volatile Organic Compound (TVOC) concentrations were within the recommended range. The Pinchin inspector did not identify any deficiencies with regards to unusual odours during the investigation.

Relative humidity measurements were below the recommended comfort range which may result in dry skin, eye and nose irritation. However, it should be noted that low relative humidity is a common wintertime condition in Canada.

Pinchin inspected the Air Handling Units (AHUs) and concluded that the AHUs are in proper working order with no leaks or standing water build up. The filters in AHU-1 and the 5th floor AHU were clean and free of visible dust and debris.

The following recommendations are offered to improve air quality in this building:

1. Communicate the findings of this report to the staff, and health and safety representitive; and
2. Review the humidification system in the building to ensure it is operational and functioning properly. Consider making adjustments as necessary.

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1.0 INTRODUCTION AND SCOPE

1.1 Statement of Understanding

Pinchin Ltd. (Pinchin) was retained by University of Manitoba (the Client) to conduct an investigation of Indoor Air Quality (IAQ) that included 24-hour monitoring. The work was conducted at 753 McDermot Avenue, Winnipeg, Manitoba. Room A106 of the Chown Building was the data logging location chosen by the client as it was fully occupied by staff and students throughout the daytime hours. Room A106 is located on the 1st floor of the Chown Building at the Bannatyne campus. The client also requested that in this location observations be made specifically on the cleanliness of supply air diffusers and return air grilles. As well an inspection of the Heating Ventilation Air Conditioning (HVAC) system was requested.

1.2 Scope of Work

Pinchin performed the investigation from March 9, 2022 to March 10, 2022. The scope of this investigation was limited to Room A106. As well as the HVAC system on the 100 and 500 Floor Levels.

The investigation involved the following activities:

- Review site via in-person walkthrough for factors that could contribute to poor indoor air quality.
- Site review of HVAC equipment servicing the entire building.
- Data-logging of Carbon Dioxide (CO_2), Carbon Monoxide (CO), Temperature (Temp), Relative Humidity (RH), Total Volatile Organic Compounds (TVOCs) and Particulate Matter smaller than 2.5 micrometres ($PM_{2.5}$) within Room A106.

2.0 METHODOLOGY

2.1 Interviews and Site Reviews

Pinchin interviewed the University of Manitoba Physical Plant, Project and Building Managers to discuss the history of the building, maintenance practices and any indoor air quality concerns.

The investigator did not perform any destructive work to inspect concealed conditions inside wall and/or ceiling cavities.

2.2 Test Methods and Criteria

The following table presents the parameters measured in this investigation, the instruments and sampling/analytical methods used, the applicable units of measurement, and the Indoor Air Quality criteria used for the evaluation of the results.

Table I – IAQ Parameters Tested, Measurement Criteria and Instruments

Parameter	Unit of Measurement	Recommended Limit	Instrumentation
Carbon dioxide, CO_2	Parts per million in air (ppm)	Outdoor Air (ppm) + 700 ppm [1]	24-hour Data-log Monitoring using a 3M® EVM-7 Air Quality Monitor
Carbon monoxide, CO	ppm	5 ppm [2]	
Temperature, T	°C	21 to 25°C, winter clothing [3]	
Relative Humidity, RH	% RH	25[4] to 65[5] %, for occupant comfort	
Total Volatile Organic Compounds, (TVOC)	Parts per billion (ppb)	400 ppb[6]	
Particulate Matter smaller than 2.5 micrometres, $PM_{2.5}$	µg/m³	25 µg/m³ [7]24-hour mean;	24-hour Data-log Monitoring using an EVM-7 Air Quality Monitor

All data-logging direct-reading instruments were calibrated before use.

3.0 FINDINGS

3.1 Results of Interviews

Project or Building Manager reported the following:

- Air Handling Units (AHU) filters are changed every three months or as needed.
- The occupant capacity within Room A106 is 44 people.

1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Ventilation for Acceptable Indoor Air Quality* [ANSI/ASHRAE Standard 62.1-2019]. Atlanta, GA: ASHRAE, 2019.
2 Health Canada: *Indoor Air Quality in Office Buildings: A Technical Guide*. Ottawa, ON: Health Canada, 1995.
3 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Thermal Environmental Conditions for Human Occupancy* [ANSI/ASHRAE Standard 55-2020]. Atlanta, GA: ASHRAE, 2020.
4 Health Canada: *Indoor Air Quality in Office Buildings: A Technical Guide*. Ottawa ON: Health Canada, 1995.
5 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Thermal Environmental Conditions for Human Occupancy* [ANSI/ASHRAE Standard 55-2020]. Atlanta, GA:ASHRAE, 2020.
6 Value calculated from: US Environmental Protection Agency (EPA) "Building Assessment Survey and Evaluation (BASE) Study [Online] Available at http://www.epa.gov/iaq/base/summarized_data.html#Volatile_Organic_Compounds (Accessed August 25, 2014).
7 W. Team, "WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide : global update 2005 : summary of risk assessment", Apps.who.int, 2021. [Online]. Available: http://apps.who.int/iris/handle/10665/69477. [Accessed: 15-Sep- 2021].

3.2 Facility Description

Table II – Facility Description

Item	Details
Construction Date	1964
Number of Floors	Five Floors Above Grade Plus Rooftop Penthouse, 1 Floor Below Grade
Exterior Cladding	Brick, Concrete
HVAC	Forced Air
Flooring	Carpet, Vinyl Floor Tiles
Interior Walls	Drywall, Wood Panel, Hollow-Core Brick
Ceilings	Acoustic Ceiling Tile, Drywall

3.3 Results of Site Reviews

Appendix I presents the drawings.

There are two Air Handling Units within Chown Building. AHU-1 provides conditioned air to the entire building with the exception of the 5th floor (Photo #1). Inside the AHU there were no leaks found or standing water (Photo #2), the filters fit properly and were observed to be clean (Photo #3). The condensate drain was free from any leaks or standing water (Photo #4).

The AHU on the 5th floor provides conditioned air to the 5th floor of the building (Photo #5). Inside the AHU there were no leaks found or standing water (Photo #6), the filters fit properly and were observed to be clean (Photo #7). The condensate drain was free from any leaks or standing water (Photo #8).

In the sampling location there were observed to be 8 supply grates (Photo #9) and 2 return grates (Photo #10). All supply diffusers and return grates are clean and free from obstructions.

The filters in AHU-1 and the AHU on the 5th floor are Minimum Efficiency Reporting Value (MERV) of 8.

Refer to Table III for photographs from the investigation.

Table III – Photographs from Investigation

Photo 1 - AHU-1

Photo 2 - Inside AHU-1 free from leaks and standing water

Photo 3 - AHU-1 filters (clean)

Photo 4 - AHU-1 condensate drain free from leaks and standing water

Photo 5 - AHU on the 5th floor

Photo 6 - Inside the AHU on the 5th floor free from leaks and standing water

Table III – Photographs from Investigation

Photo 7 - AHU on the 5th floor filters (clean)

Photo 8 - AHU on the 5th floor condensate drain free from leaks and standing water

Photo 9 - Room A106 Supply Grate

Photo 10 - Room A106 Return Grate

3.4 Results of Indoor Air Quality Tests

Appendix II presents the results of data-logging for IAQ parameters.

The EVM 7 air monitor was used for 24-hour data logging, for just $PM_{2.5}$, CO_2, CO, TVOC, Temperature, and Relative Humidity. The EVM-7 is a direct-reading instrument and were calibrated before use.

3.4.1 Carbon Dioxide (CO_2)

The 24-hour minimum CO_2 concentration recorded within the building was 375 ppm, the maximum CO_2 concentration was 735 ppm. The 24-hour average for CO_2 was 462 ppm. The average CO_2 concentration during **the occupied time** was 624 ppm. On March 9 and March 10 outdoor spot measurements were recorded. The average outdoor CO2 spot measurements for the two days was 423 ppm. The indoor carbon dioxide concentrations were below the limit of 1,123 ppm (423 ppm outdoors plus 700 ppm) recommended by American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) This indicates that the volume of the supply air was adequate for the occupancy loading at the time of the investigation.

3.4.2 Carbon Monoxide (CO)

The 24-hour minimum CO concentration recorded within the building was below the detection limit of the instrumentation, the maximum CO concentration was 1 ppm. The 24-hour average for CO was 0.001 ppm. The average CO concentration during **the occupied time** was below the detection limit of the instrumentation. On March 9 and March 10 outdoor spot measurements were recorded. The average outdoor CO spot measurements for the two days was below the detection limit of the instrumentation. Health Canada advises that the detection of carbon monoxide above 5 ppm indicates a concern requiring further investigation.

3.4.3 Temperature (Temp)

The 24-hour minimum temperature measurement was 20.5 °C, the maximum temperature measurement was 24.0 °C. The 24-hour average temperature measurement was 23.6 °C. The average temperature measurement during **the occupied time** was 23.8 °C. On March 9 and March 10 outdoor spot measurements were taken each day, averaging -19.5 °C for these dates. The indoor temperatures were within the recommended comfort ranges for office environments for typical dress during winter conditions, of 21 to 25 °C.

3.4.4 Relative Humidity (RH)

The 24-hour minimum Relative Humidity measurement was 2.4 %RH, the maximum measurement was 25.9 %RH. The 24-hour average measurement for relative humidity was 5.6 %RH. The average relative humidity measurement during **the occupied time** was 5.82 %RH. On March 9 and March 10 outdoor spot measurements were taken each day, averaging 64 %RH for these dates. Relative humidity below 25 %RH may result in complaints of dry skin and eye and nose irritation. Low relative humidity is a common winter time condition in Canada due to difficulties maintaining proper humidification.

3.4.5 Airborne Dust ($PM_{2.5}$)

The 24-hour minimum concentration for $PM_{2.5}$ was below the detection limit of the monitoring instrument, the maximum concentration for $PM_{2.5}$ was 9 µg/m³. The 24-hour average concentration for $PM_{2.5}$ was 0.04 µg/m³. The average $PM_{2.5}$ concentration during **the occupied time** was 0.09 µg/m³. On March 9 and March 10 outdoor spot measurements were taken each day, averaging 26 µg/m³ for these dates. For reference, World Health Organization (WHO) provides a guideline of 25 µg/m³ over a 24-hour period. The indoor $PM_{2.5}$ concentrations in this building were within the recommended range.

3.4.6 Total Volatile Organic Compounds (TVOC)

The TVOC concentrations were non-detectable or just at the detection limit of the instrumentation for the duration of the 24-hour monitoring. Based on US EPA research, office environments with TVOC concentrations up to 400 ppb would be at little risk of IAQ concern. As this is a guideline, complaints might be expected if concentrations were significantly above 400 ppb.

Table IV – Summary of 24-Hour Data-logging IAQ based on Indoor Air Quality Criteria

Parameter	**Measurement Average**	**Indoor Air Quality Measurement Criteria**	**Below Indoor Air Quality Measurement Criteria?**
Carbon Dioxide	462 ppm	Outdoor Air (ppm) + 700 ppm	Yes
Carbon Monoxide	0.001 ppm	5ppm	Yes
Temperature (°C)	23.6 °C	21 to 25 °C, winter clothing	Yes
Relative Humidity (%)	5.6% RH	25 to 65 %, for occupant comfort	No
$PM_{2.5}$	0.04 µg/m³	25 µg/m³	Yes
TVOC	Below Detection Limit of the Instrumentation	400 ppb	Yes

4.0 DISCUSSION

The majority of the indoor air quality measurements collected were within recommended ranges and meet the criteria of the referenced guidelines. Carbon dioxide concentrations suggested adequate ventilation. Carbon monoxide concentrations did not suggest the presence of exhaust or combustion gases. Temperature measurements were within the recommended comfort ranges for office environments. $PM_{2.5}$ concentrations were within typical ranges. Total Volatile Organic Compound (TVOC) concentrations were within the recommended range. The Pinchin inspector did not identify any deficiencies with regards to unusual odours during the investigation.

Relative humidity measurements were below the recommended comfort range which may result in dry skin, eye and nose irritation. However, it should be noted that low relative humidity is a common wintertime condition in Canada.

Pinchin inspected the Air Handling Units (AHUs) and concluded that the AHUs are in proper working order with no leaks or standing water build up. The filters in AHU-1 and the 5th floor AHU were clean and free of visible dust and debris.

5.0 RECOMMENDATIONS

Pinchin offers the following recommendations to improve air quality in this building.

1. Communicate the findings of this report to the staff, and health and safety representitive; and
2. Review the humidification system in the building to ensure it is operational and functioning properly. Consider making adjustments as necessary.

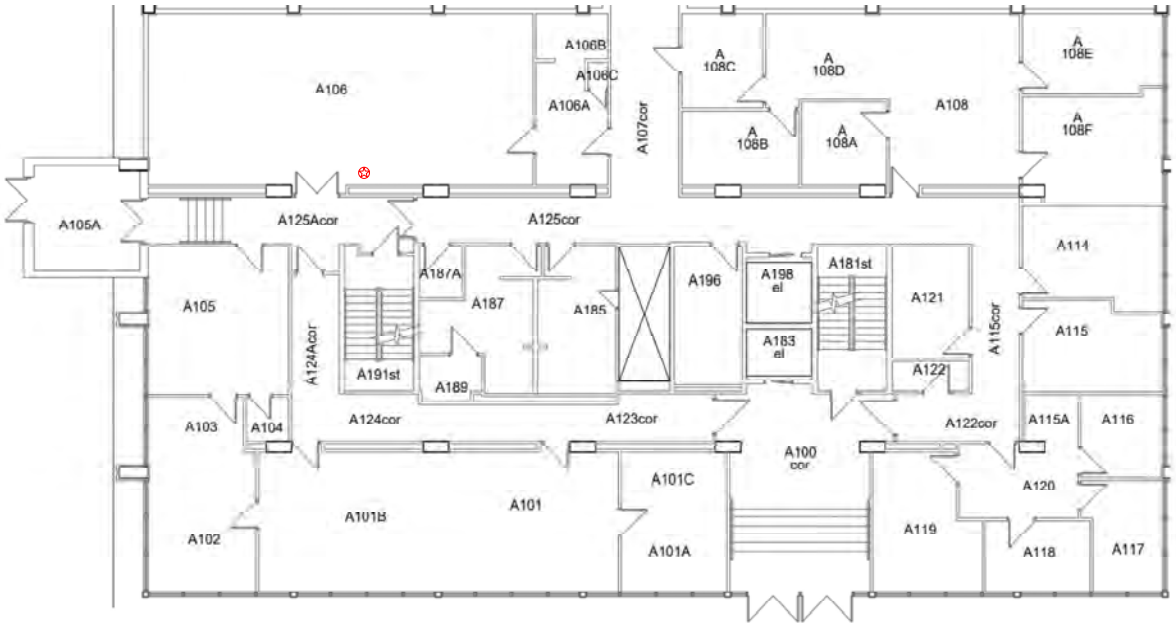
6.0 TERMS AND LIMITATIONS

This work was performed subject to the Terms and Limitations presented or referenced in the proposal for this project.

Information provided by Pinchin is intended for Client use only. Pinchin will not provide results or information to any party unless disclosure by Pinchin is required by law. Any use by a third party of reports or documents authored by Pinchin or any reliance by a third party on or decisions made by a third party based on the findings described in said documents, is the sole responsibility of such third parties. Pinchin accepts no responsibility for damages suffered by any third party as a result of decisions made or actions conducted. No other warranties are implied or expressed.

APPENDIX I

Drawing(s)



N

LEGEND

DATA LOGGING LOCATION

BASE PLAN PROVIDED BY CLIENT.

PINCHIN

PROJECT NAME:
INDOOR AIR QUALITY ASSESSMENT

CLIENT NAME:
UNIVERSITY OF MANITOBA CHOWN

PROJECT LOCATION:
753 MCDERMOT AVENUE WINNIPEG, MANITOBA

FIGURE NAME:
LEVEL 100

PROJECT NUMBER:	SCALE:
306866	NOT TO SCALE
DRAWN BY:	REVIEWED BY:
CE	JB
DATE:	FIGURE NUMBER:
2022/04/1	1 OF 1

APPENDIX II

Results of Data-Logging Indoor Air Quality Measurements

Session Report
Chown Building
753 McDermot Avenue

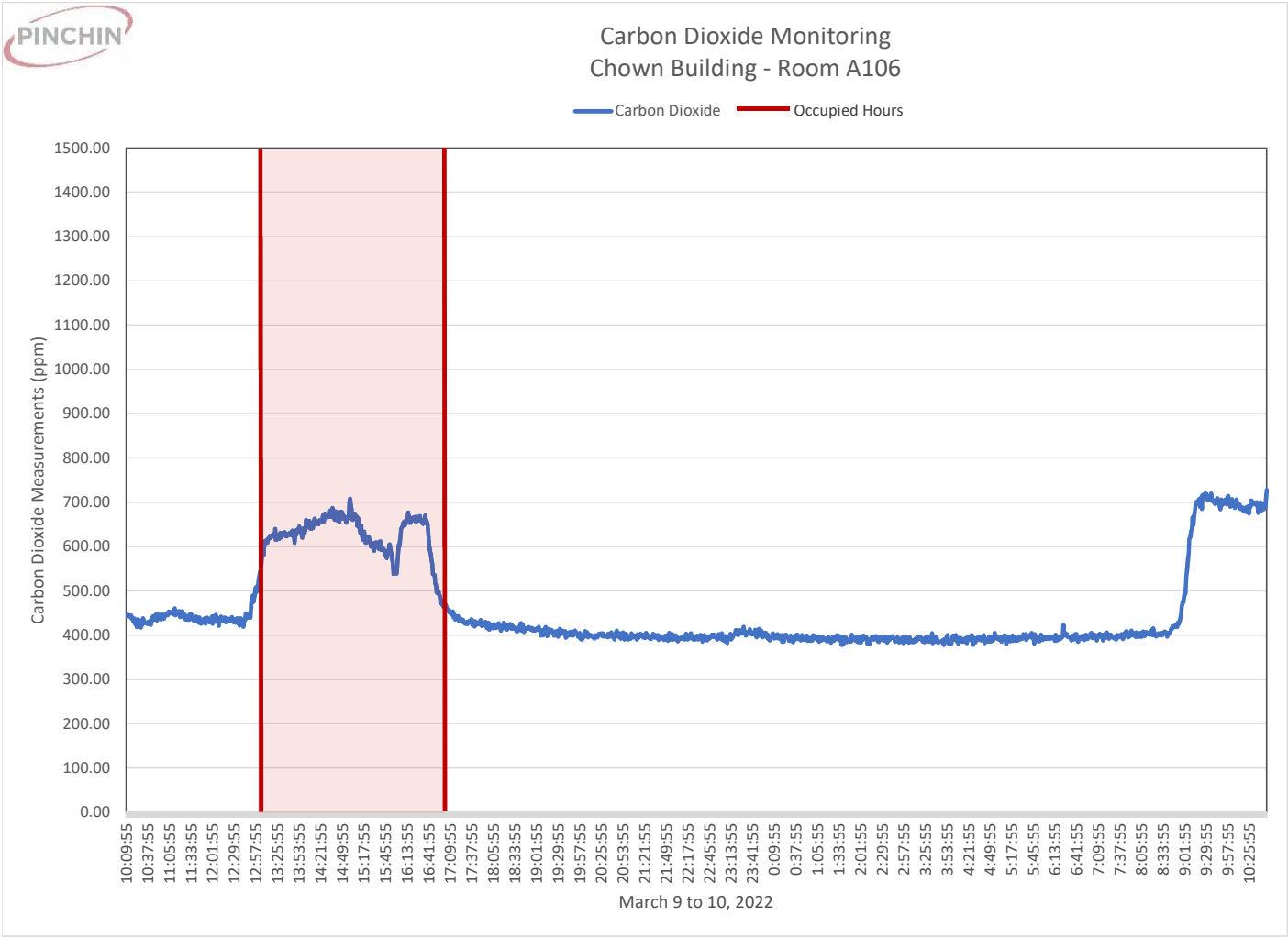
3/10/2022

Datalog Period

Device Name	EML090039
Serial Number	EML090039
Run Time	1.00:37:56
Start Time	3/9/2022 10:08:55 AM
Stop Time	3/10/2022 10:46:51 AM

IAQ Data Summary

Description	Value	Description	Value
CO2Ave	462 PPM	CO2Max	735 PPM
CO2MaxTime	3/10/2022 10:48:29 AM	CO2Min	375 PPM
COAve	0.01 PPM	COMax	1 PPM
COMin	0 PPM	Dust Average	0.04 ug/m³
Dust Max	9.000 ug/m³	Dust Min	0.000 ug/m³
Humidity Avg	5.6 %	Humidity Max	25.9 %
Humidity Max Time	3/9/2022 7:59:41 PM	Humidity Min	2.4 %
Humidity Min Time	3/10/2022 7:53:30 AM	PIDAvePPB	Below the Detection Limit of the Instrument
PIDMaxPPB	Below the Detection Limit of the Instrument	PIDMinPPB	Below the Detection Limit of the Instrument
Temp Avg	23.6 °C	Temp Max Time	3/10/2022 7:15:11 AM
Temp Min Time	3/9/2022 10:08:55 AM	Temperature Max	24 °C
Temperature Min	20.5 °C		
Dust Impactor Setting	2.5 µm		


PINCHIN
Carbon Dioxide Monitoring
Chown Building - Room A106
Carbon Dioxide
Occupied Hours
Carbon Dioxide Measurements (ppm)
1500.00
1400.00
1300.00
1200.00
1100.00
1000.00
900.00
800.00
700.00
600.00
500.00
400.00
300.00
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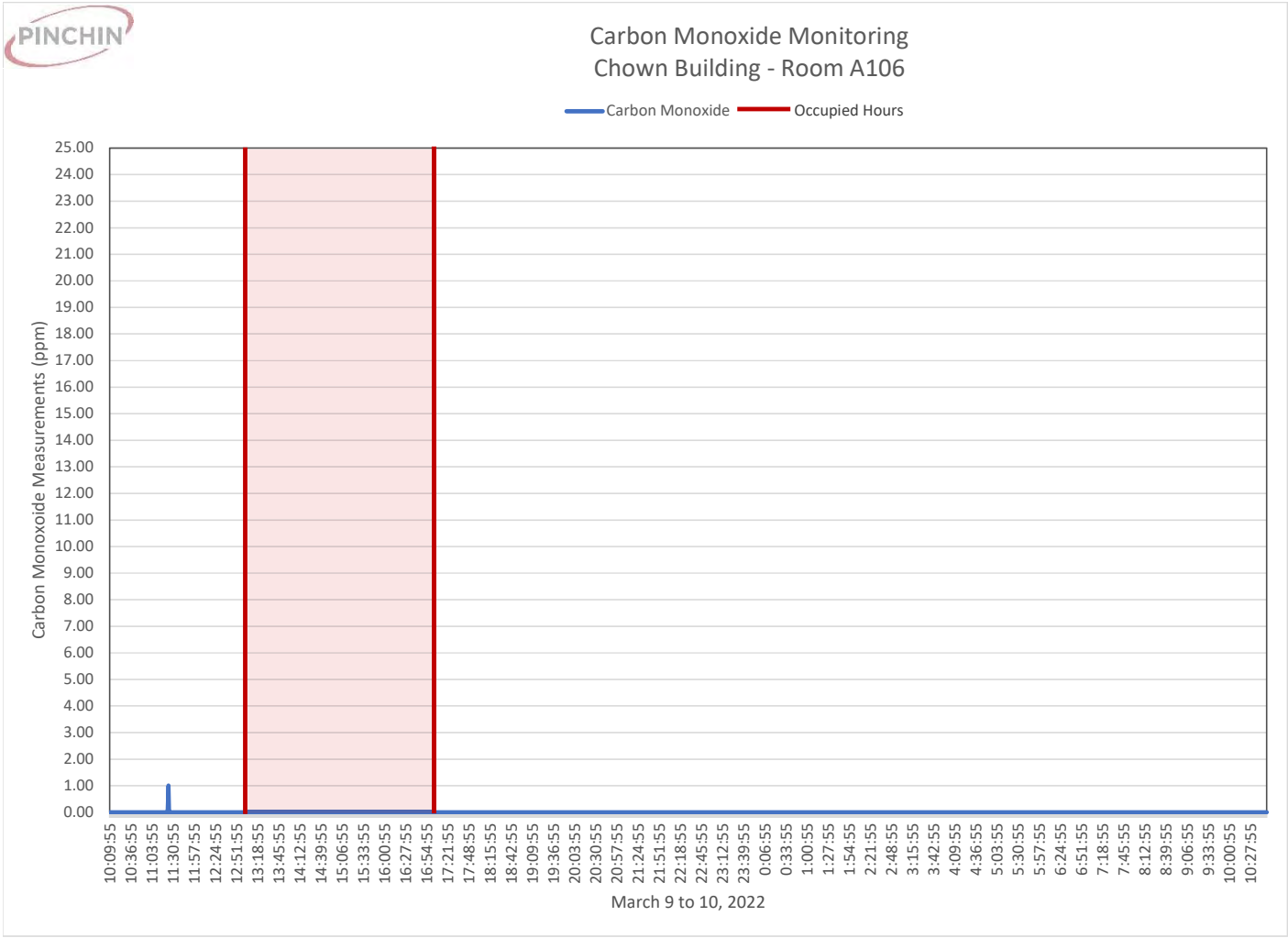
March 9 to 10, 2022


PINCHIN
Carbon Monoxide Monitoring
Chown Building - Room A106
Carbon Monoxide
Occupied Hours
Carbon Monoxide Measurements (ppm)
25.00
24.00
23.00
22.00
21.00
20.00
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16.00
15.00
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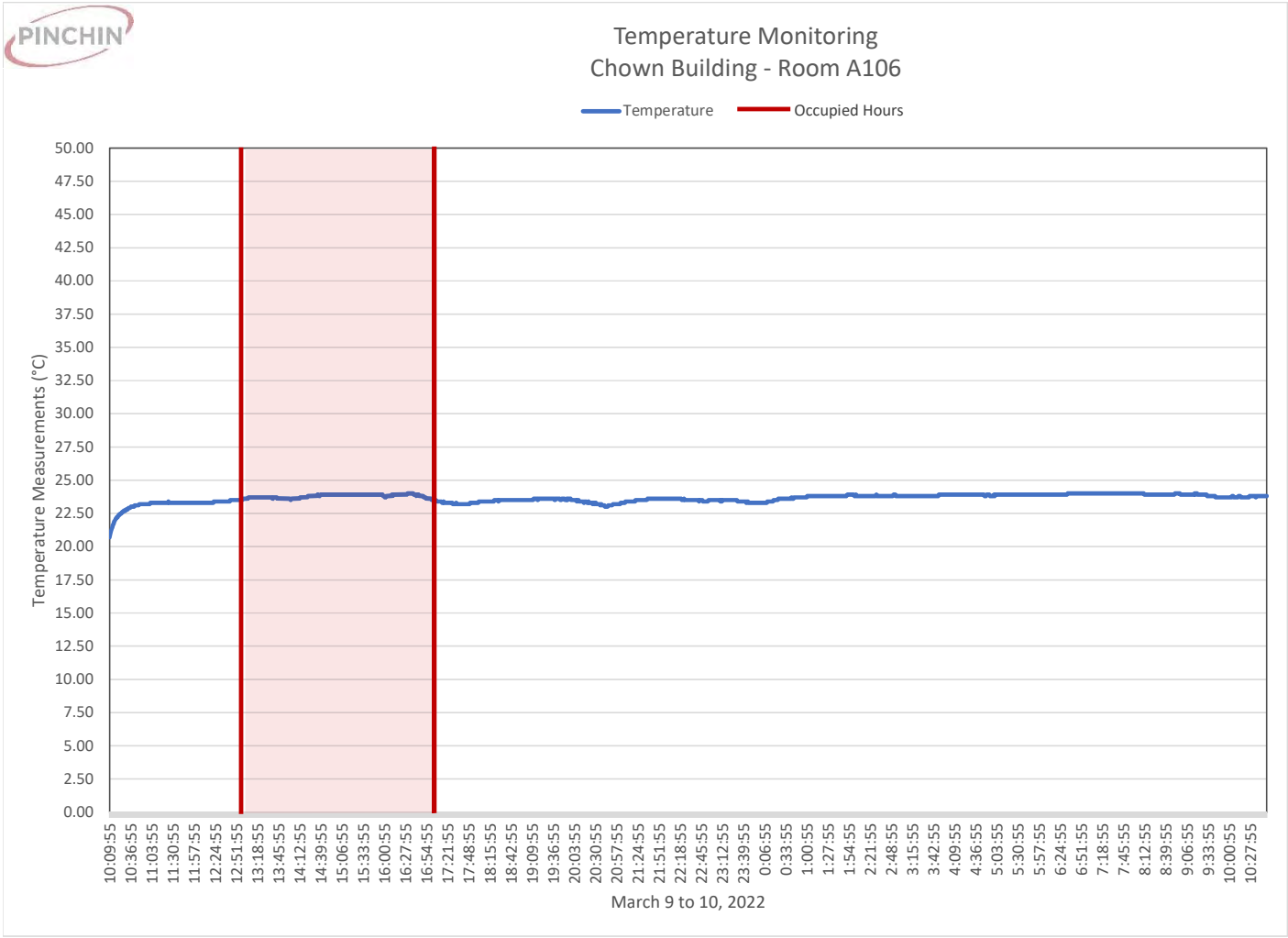
23:12:55
23:39:55
0:06:55
0:33:55
1:00:55
1:27:55
1:54:55
2:21:55
2:48:55
3:15:55
3:42:55
4:09:55
4:36:55
5:03:55
5:30:55
5:57:55
6:24:55
6:51:55
7:18:55
7:45:55
8:12:55
8:39:55
9:06:55
9:33:55
10:00:55
10:27:55
March 9 to 10, 2022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Temperature Monitoring
Chown Building - Room A106
Temperature
Occupied Hours
Temperature Measurements (°C)
50.00
47.50
45.00
42.50
40.00
37.50
35.00
32.50
30.00
27.50
25.00
22.50
20.00
17.50
15.00
12.50
10.00
7.50
5.00
2.50
0.00
10:09:55
10:36:55
11:03:55
11:30:55
11:57:55
12:24:55
12:51:55
13:18:55
13:45:55
14:12:55
14:39:55
15:06:55
15:33:55
16:00:55
16:27:55
16:54:55
17:21:55
17:48:55
18:15:55
18:42:55
19:09:55
19:36:55
20:03:55
20:30:55
20:57:55
21:24:55
21:51:55
22:18:55
22:45:55
23:12:55
23:39:55
0:06:55
0:33:55
1:00:55
1:27:55
1:54:55
2:21:55
2:48:55
3:15:55
3:42:55
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5:03:55
5:30:55
5:57:55
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6:51:55
7:18:55
7:45:55
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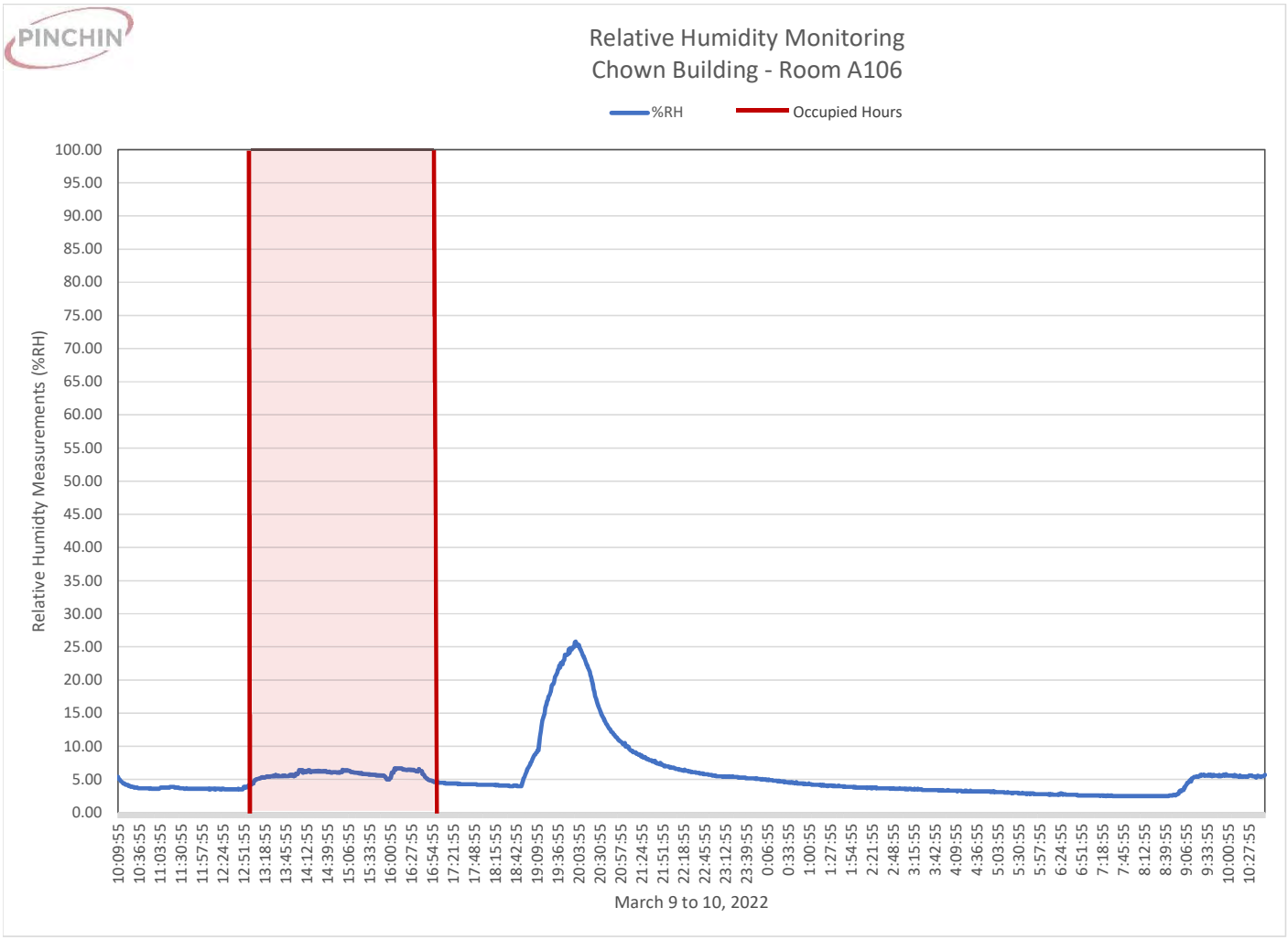
9:33:55
10:00:55
10:27:55
March 9 to 10, 2022


PINCHIN
Relative Humidity Monitoring
Chown Building - Room A106
%RH
Occupied Hours
Relative Humidty Measurements (%RH)
100.00
95.00
90.00
85.00
80.00
75.00
70.00
65.00
60.00
55.00
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
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13:45:55
14:12:55
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15:33:55
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21:24:55
21:51:55
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3:15:55
3:42:55
4:09:55
4:36:55
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6:24:55
6:51:55
7:18:55
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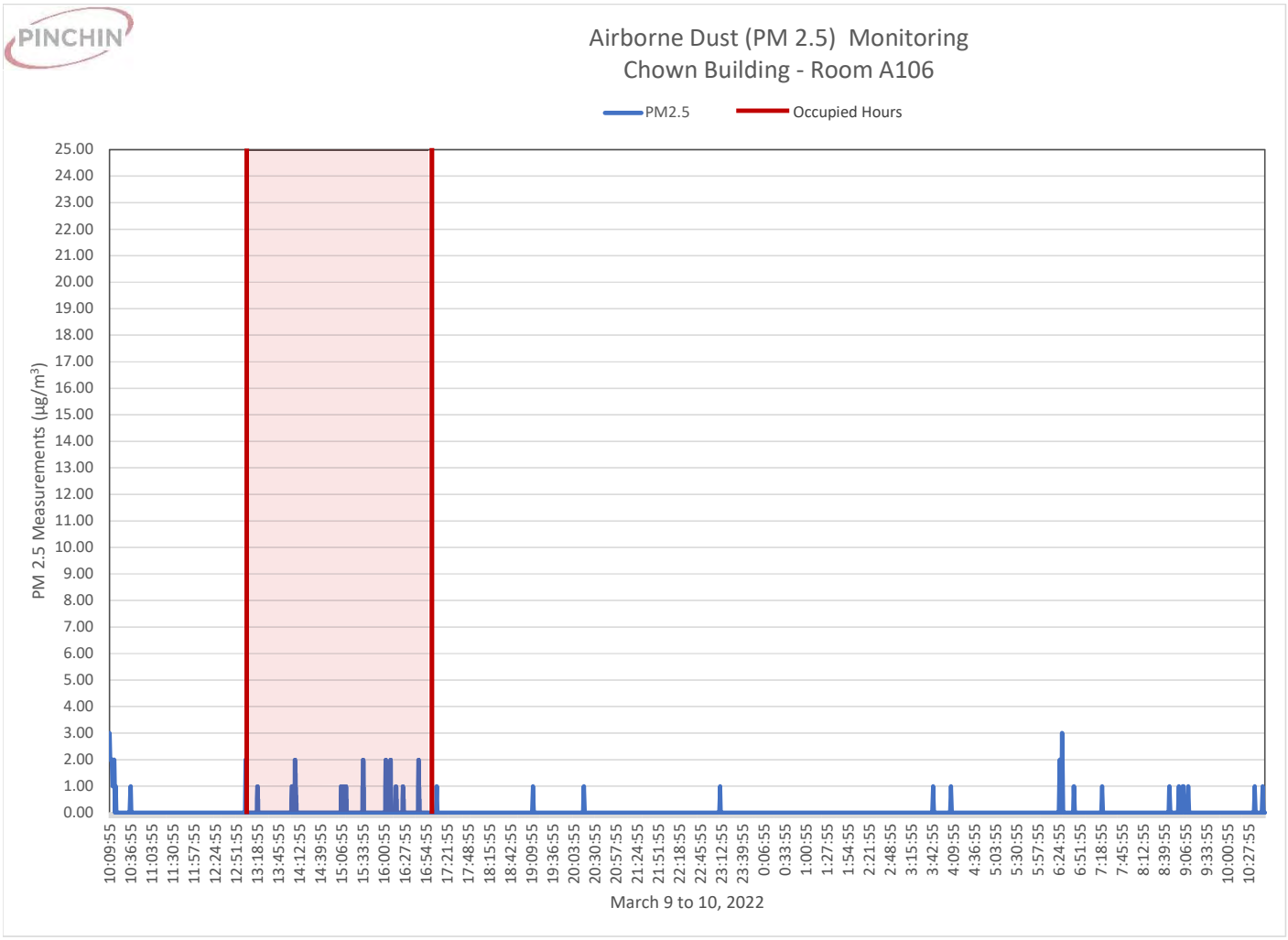
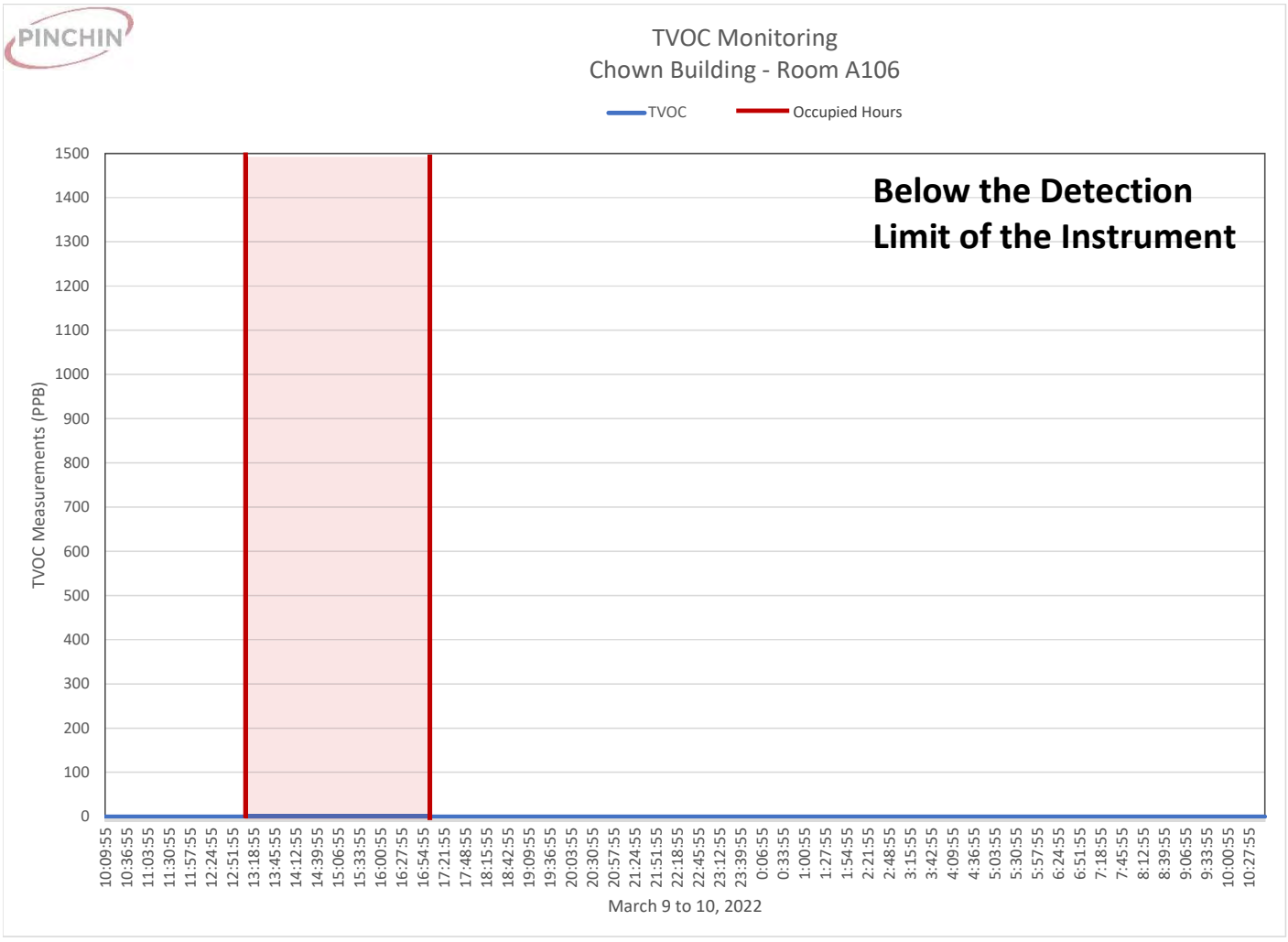
March 9 to 10, 2022


PINCHIN
Airborne Dust (PM 2.5) Monitoring
Chown Building - Room A106
PM2.5
Occupied Hours
PM 2.5 Measurements (µg/m³)
25.00
24.00
23.00
22.00
21.00
20.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
10:09:55
10:36:55
11:03:55
11:30:55
11:57:55
12:24:55
12:51:55
13:18:55
13:45:55
14:12:55
14:39:55
15:06:55
15:33:55
16:00:55
16:27:55
16:54:55
17:21:55
17:48:55
18:15:55
18:42:55
19:09:55
19:36:55
20:03:55
20:30:55
20:57:55
21:24:55
21:51:55
22:18:55
22:45:55
23:12:55
23:39:55
0:06:55
0:33:55
1:00:55
1:27:55
1:54:55
2:21:55
2:48:55
3:15:55
3:42:55
4:09:55
4:36:55
5:03:55
5:30:55
5:57:55
6:24:55
6:51:55
7:18:55
7:45:55
8:12:55
8:39:55
9:06:55
9:33:55
10:00:55
10:27:55
March 9 to 10, 2022


PINCHIN
TVOC Monitoring
Chown Building - Room A106
TVOC
Occupied Hours
Below the Detection Limit of the Instrument
TVOC Measurements (PPB)
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
10:09:55
10:36:55
11:03:55
11:30:55
11:57:55
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12:51:55
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13:45:55
14:12:55
14:39:55
15:06:55
15:33:55
16:00:55
16:27:55
16:54:55
17:21:55
17:48:55
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18:42:55
19:09:55
19:36:55
20:03:55
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21:24:55
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22:45:55
23:12:55
23:39:55
0:06:55
0:33:55
1:00:55
1:27:55
1:54:55
2:21:55
2:48:55
3:15:55
3:42:55
4:09:55
4:36:55
5:03:55
5:30:55
5:57:55
6:24:55
6:51:55
7:18:55
7:45:55
8:12:55
8:39:55
9:06:55
9:33:55
10:00:55
10:27:55
March 9 to 10, 2022

FINAL

Investigation of Indoor Air Quality

Dentistry Building
780 Bannatyne Avenue, Winnipeg, Manitoba

Prepared for:

University of Manitoba
120 Physical Plant, 89 Freedman Crescent
Winnipeg, Manitoba R3T 2N2

April 14, 2022

Pinchin File: 306866

Issued to:	**University of Manitoba**
Issued on:	**April 14, 2022**
Pinchin File:	**306866**
Issuing Office:	**Winnipeg, MB**

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EXECUTIVE SUMMARY

Pinchin Ltd. (Pinchin) was retained by University of Manitoba (the Client) to conduct an investigation of indoor air quality (IAQ) that included 24 hour data-log monitoring. The work was conducted at 780 Bannatyne Avenue, Winnipeg, Manitoba. Room D220 of the Dentistry Building was the data logging location chosen by the client as it was occupied by staff and students during the hours of 08:00 – 12:00 and 13:00 - 17:00. Room D220 is located on the 200 Level of the Dentistry Building at the Bannatyne campus. The client also requested that in the location where the 24-hour monitoring occurred, observations be made specifically to the cleanliness of supply air diffusers and return air grilles. As this is a follow up to the October 14, 2021, assessment, a re-inspection of the Heating Ventilation Air Conditioning (HVAC) system was not performed.

The majority of the indoor air quality measurements collected were within recommended ranges and meet the criteria of the guidelines referenced. Carbon dioxide concentrations suggested adequate ventilation. Carbon monoxide concentrations did not suggest the presence of exhaust or combustion gases. Temperature measurements were within the recommended comfort ranges for office environments. $PM_{2.5}$ concentrations were within typical ranges. Total Volatile Organic Compound (TVOC) concentrations were within the recommended range The Pinchin inspector did not identify any deficiencies with regards to unusual odours during the investigation.

Relative Humidity measurements were below the recommended comfort range which may result in dry skin, eye and nose irritation. However, it should be noted that low relative humidity is a common wintertime condition in Canada.

One water stained ceiling tile was observed within Room D220. Ceiling tiles can support mould growth if subjected to persistent wetting. The water stained ceiling tile should be removed and replaced. The new tile should be monitored for evidence of recurring leaks and underlying repairs should made where necessary.

The following recommendations are offered to improve air quality in this building:

1. Communicate the findings of this report to the staff, and health and safety representitive;
2. Review the humidification system in the building to ensure it is operational and functioning properly. Consider making adjustments as necessary. and
3. Remove and replace the water stained ceiling tile. Monitor the new tile for any further staining. If water damage reoccurs the source of the moisture should be identified and repaired.

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1.0 INTRODUCTION AND SCOPE

1.1 Statement of Understanding

Pinchin Ltd. (Pinchin) was retained by University of Manitoba (the Client) to conduct an investigation of indoor air quality (IAQ) that included 24 hour data-log monitoring. The work was conducted at 780 Bannatyne Avenue, Winnipeg, Manitoba. Room D220 of the Dentistry Building was the data logging location chosen by the client as it was occupied by staff and students during the hours of 08:00 – 12:00 and 13:00 - 17:00. Room D220 is located on the 200 Level of the Dentistry Building at the Bannatyne campus. The client also requested that in this location, observations be made specifically to the cleanliness of supply air diffusers and return air grilles. As this is a follow up to the October 14, 2021, assessment, a re-inspection of the Heating Ventilation Air Conditioning (HVAC) system was not performed.

1.2 Scope of Work

Pinchin performed the investigation on March 11, 2022 to March 12, 2022. The scope of this investigation was limited to Room D220.

The investigation involved the following activities:

- Walkthrough site reviews for factors that could degrade air quality; and
- Data-logging of Carbon Dioxide (CO_2), Carbon Monoxide (CO), Temperature (Temp), Relative Humidity (RH), Total Volatile Organic Compounds (TVOCs) and Particulate Matter smaller than 2.5 micrometres ($PM_{2.5}$) within Room D220.

2.0 METHODOLOGY

2.1 Interviews and Site Reviews

Pinchin interviewed the University of Manitoba Physical Plant, Project and Building Managers to discuss the history of the building, maintenance practices and any indoor air quality concerns.

The investigator did not perform any destructive work to inspect concealed conditions inside wall and/or ceiling cavities.

2.2 Test Methods and Criteria

The following table presents the parameters measured in this investigation, the instruments, the applicable units of measurement, and the Indoor Air Quality criteria used for the evaluation of the results.

Table I – IAQ Parameters Tested, Measurement Criteria and Instruments

Parameter	Unit of Measurement	Recommended Limit	Instrumentation
Carbon dioxide, CO_2	Parts per million in air (ppm)	Outdoor Air (ppm) + 700 ppm [1]	24 hour Data-log Monitoring using a 3M® EVM-7 Air Quality Monitor
Carbon monoxide, CO	ppm	5 ppm [2]	
Temperature, T	°C	21 to 25 °C, winter clothing [3]	
Relative Humidity, RH	%RH	25[4] to 65[5] %, for occupant comfort	
Total Volatile Organic Compounds, (TVOC)	Parts per billion (ppb)	400 ppb[6]	
Particulate Matter smaller than 2.5 micrometres, $PM_{2.5}$	µg/m³	25 µg/m³ [7]24-hour mean;	24 hour Data-log Monitoring using an EVM-7 Air Quality Monitor

All data-logging direct-reading instruments were calibrated before use.

3.0 FINDINGS

3.1 Results of Interviews

Project or Building Manager reported the following:

- Air Handling Units (AHU) filters are changed every three months or as needed;
- The occupant capacity within Room D220 is 32 people; and
- The enrollment/class ranges from 25 people.

1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Ventilation for Acceptable Indoor Air Quality* [ANSI/ASHRAE Standard 62.1-2019]. Atlanta, GA: ASHRAE, 2019.
2 Health Canada: *Indoor Air Quality in Office Buildings: A Technical Guide*. Ottawa, ON: Health Canada, 1995.
3 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Thermal Environmental Conditions for Human Occupancy* [ANSI/ASHRAE Standard 55-2020]. Atlanta, GA: ASHRAE, 2020.
4 L.E. Burton, J.G. Girman, S.E. Womble: Airborne particulate matter within 100 randomly selected office buildings in the United States (BASE). Proceedings of Healthy Buildings 2000, Vol. 1 (2001).
5 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Thermal Environmental Conditions for Human Occupancy* [ANSI/ASHRAE Standard 55-2020]. Atlanta, GA:ASHRAE, 2020.
6 Value calculated from: US Environmental Protection Agency (EPA) "Building Assessment Survey and Evaluation (BASE) Study [Online] Available at http://www.epa.gov/iaq/base/summarized_data.html#Volatile_Organic_Compounds (Accessed August 25, 2014).
7 W. Team, "WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide : global update 2005 : summary of risk assessment", Apps.who.int, 2021. [Online]. Available: http://apps.who.int/iris/handle/10665/69477. [Accessed: 15-Sep- 2021].

3.2 Facility Description

Table II – Facility Description

Item	Details
Construction Date	1906
Number of Floors	3 floors above grade, 1 floor below grade
Structural Type	Steel
Foundation Type	Concrete
Exterior Cladding	Brick
HVAC	Forced air
Roof	Built up
Flooring	Vinyl sheet flooring
Interior Walls	Drywall
Ceilings	Acoustic ceiling tile

3.3 Results of Site Reviews

Appendix I presents the drawings.

During the investigation Pinchin noted the supply diffusers were clear from any obstructions and were observed clean.

The Pinchin investigator noted one water stained ceiling tile (Photo #1).

Refer to Table III for photographs from the investigation.

Table III – Photographs from Investigation

Photo 1 - Water stained ceiling tile within Room D220

3.4 Results of Indoor Air Quality Tests

Appendix II presents the results of data-logging for IAQ parameters.

The EVM 7 air monitor was used for 24-hour data logging, for just $PM_{2.5}$, CO_2, CO, TVOC, Temperature, and Relative Humidity. The EVM-7 is a direct-reading instrument and were calibrated before use.

3.4.1 Carbon Dioxide (CO_2)

The 24-hour minimum CO_2 concentration recorded within the building was 385 ppm, the maximum CO_2 concentration was 785 ppm. The 24-hour average for CO_2 was 471 ppm. The average CO_2 concentration during **the occupied time** was 577 ppm. On March 11 and March 12 outdoor spot measurements were recorded. The average outdoor CO2 spot measurements for the two days was 409 ppm. The carbon dioxide concentrations were below the limit of 1,109 ppm (409 ppm outdoors plus 700 ppm) recommended by American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) to provide indoor air quality acceptable to the majority of occupants. This indicates that the volume of the supply air was adequate for the occupancy loading at the time of the investigation.

3.4.2 Carbon Monoxide (CO)

The carbon monoxide concentrations were non-detectable or just at the detection limit of the instrumentation for the duration of the 24-hour monitoring. Health Canada advises that the detection of carbon monoxide above 5 ppm indicates a concern requiring further investigation.

3.4.3 Temperature (Temp)

The 24-hour minimum temperature measurement was 19.0 °C, the maximum temperature measurement was 22.2 °C. The 24-hour average temperature measurement was 21 °C. The average temperature measurement during **the occupied time** was 21.3 °C. On March 11 and March 12 outdoor spot measurements were taken each day, averaging -22.0 °C for these dates. The indoor temperatures were within the recommended comfort ranges for office environments for typical dress during winter conditions, of 21 to 25 °C.

3.4.4 Relative Humidity (RH)

The 24-hour minimum Relative Humidity measurement was 2.7 %RH, the maximum measurement was 8.5 %RH. The 24-hour average measurement for relative humidity was 4.3 %RH. The average relative humidity measurement during **the occupied time** was 5.3 %RH. On March 11 and March 12 outdoor spot measurements were taken each day, averaging 65.0 %RH for these dates. Relative humidity below 25 %RH may result in complaints of dry skin and eye and nose irritation. Low relative humidity is a common winter time condition in Canada due to difficulties with humidification.

3.4.5 Particulate Matter ($PM_{2.5}$)

The 24-hour minimum concentration for $PM_{2.5}$ was below the detection limit of the monitoring instrument, the maximum concentration for $PM_{2.5}$ was 57 µg/m³. The 24-hour average concentration for $PM_{2.5}$ was 1 µg/m³. The average $PM_{2.5}$ concentration during **the occupied time** was 3 µg/m³. On March 11 and March 12 outdoor spot measurements were taken each day, averaging 9 µg/m³ for these dates. For reference, World Health Organization (WHO) provides a guideline of 25 µg/m³ over a 24-hour period. The $PM_{2.5}$ concentrations in this building fell within the range typically measured in commercial buildings. There were various spikes throughout the monitoring period. The spikes are as follows:

- March 11 at 12:02 to 12:09 for 7 minutes and range from 34 to 48 µg/m³;
- March 11 at 13:09 to 13:13 for 4 minutes and range from 26 to 42 µg/m³;
- March 11 at 13:16 to 13:21 for 5 minutes and range from 27 to 33 µg/m³; and
- March 11 at 13:25 to 13:29 for 4 minutes and range from 27 to 32 µg/m³.

Although there are four occasions of spikes, they are of short duration and the average for **the occupied time** is well below the recommended measurement criteria.

3.4.6 Total Volatile Organic Compounds (TVOC)

The TVOC concentrations were non-detectable or just at the detection limit of the instrumentation for the duration of the 24-hour monitoring. Based on US EPA research, office environments with TVOC concentrations up to 400 ppb would be at little risk of IAQ concern. As this is a guideline, complaints might be expected if concentrations were significantly above 400 ppb.

Table IV – Summary of 24-Hour Data-logging IAQ based on Indoor Air Quality Criteria

Parameter	**Measurement Average**	**Indoor Air Quality Measurement Criteria**	**Below Indoor Air Quality Measurement Criteria?**
Carbon Dioxide	471 ppm	Outdoor Air (ppm) + 700 ppm	Yes
Carbon Monoxide	**Below the Detection Limit of the Monitoring Instrument**	5ppm	Yes
Temperature (°C)	21.0 °C	21 to 25 °C, winter clothing	Yes
Relative Humidity (%)	4.3 %	25 to 65 %, for occupant comfort	No
$PM_{2.5}$	1 µg/m³	25 µg/m³	Yes
TVOC	**Below the Detection Limit of the Monitoring Instrument**	400 ppb	Yes

4.0 DISCUSSION

The majority of the indoor air quality measurements collected were within recommended ranges and meet the criteria of the guidelines referenced. Carbon dioxide concentrations suggested adequate ventilation. Carbon monoxide concentrations did not suggest the presence of exhaust or combustion gases. Temperature measurements were within the recommended comfort ranges for office environments. $PM_{2.5}$ concentrations were within typical ranges. Total Volatile Organic Compound (TVOC) concentrations were within the recommended range The Pinchin inspector did not identify any deficiencies with regards to unusual odours during the investigation.

Relative Humidity measurements were below the recommended comfort range which may result in dry skin, eye and nose irritation. However, it should be noted that low relative humidity is a common wintertime condition in Canada.

One water stained ceiling tile was observed within Room D220. Ceiling tiles can support mould growth if subjected to persistent wetting. The water stained ceiling tiles should be removed and replaced. The new tile should be monitored for evidence of recurring leaks and underlying repairs should made where necessary.

5.0 RECOMMENDATIONS

Pinchin offers the following recommendations to improve air quality in this building.

1. Communicate the findings of this report to the staff, and health and safety representitive;
2. Review the humidification system in the building to ensure it is operational and functioning properly. Consider making adjustments as necessary; and
3. Remove and replace the water stained ceiling tile. Monitor the new tiles for any further staining. If water damage reoccurs the source of the moisture should be identified and repaired.

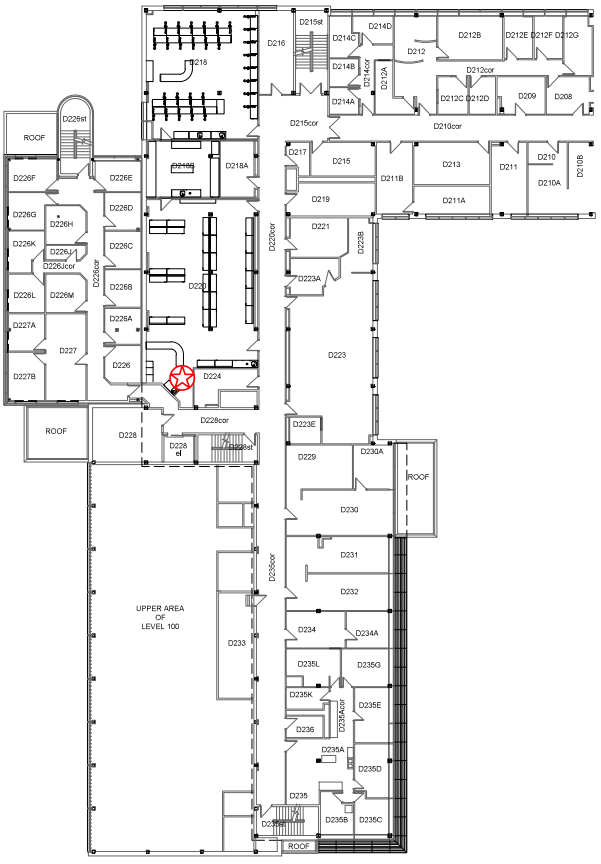
6.0 TERMS AND LIMITATIONS

This work was performed subject to the Terms and Limitations presented or referenced in the proposal for this project.

Information provided by Pinchin is intended for Client use only. Pinchin will not provide results or information to any party unless disclosure by Pinchin is required by law. Any use by a third party of reports or documents authored by Pinchin or any reliance by a third party on or decisions made by a third party based on the findings described in said documents, is the sole responsibility of such third parties. Pinchin accepts no responsibility for damages suffered by any third party as a result of decisions made or actions conducted. No other warranties are implied or expressed.

APPENDIX I

Drawing



N

LEGEND

DATA LOGGING LOCATION

BASE PLAN PROVIDED BY CLIENT.

PINCHIN

PROJECT NAME:
INDOOR AIR QUALITY ASSESSMENT

CLIENT NAME:
UNIVERSITY OF MANITOBA

PROJECT LOCATION:
DENTISTRY BUILDING
780 BANNATYNE AVENUE
WINNIPEG, MANITOBA

FIGURE NAME:
LEVEL 200

PROJECT NUMBER:	SCALE:
306866	NOT TO SCALE
DRAWN BY:	REVIEWED BY:
CE	JB
DATE:	FIGURE NUMBER:
APRIL 2022	1 OF 1

APPENDIX II

Results of Data-Logging Indoor Air Quality Measurements

Session Report
Dentistry Building, Room D220
780 Bannatyne Avenue

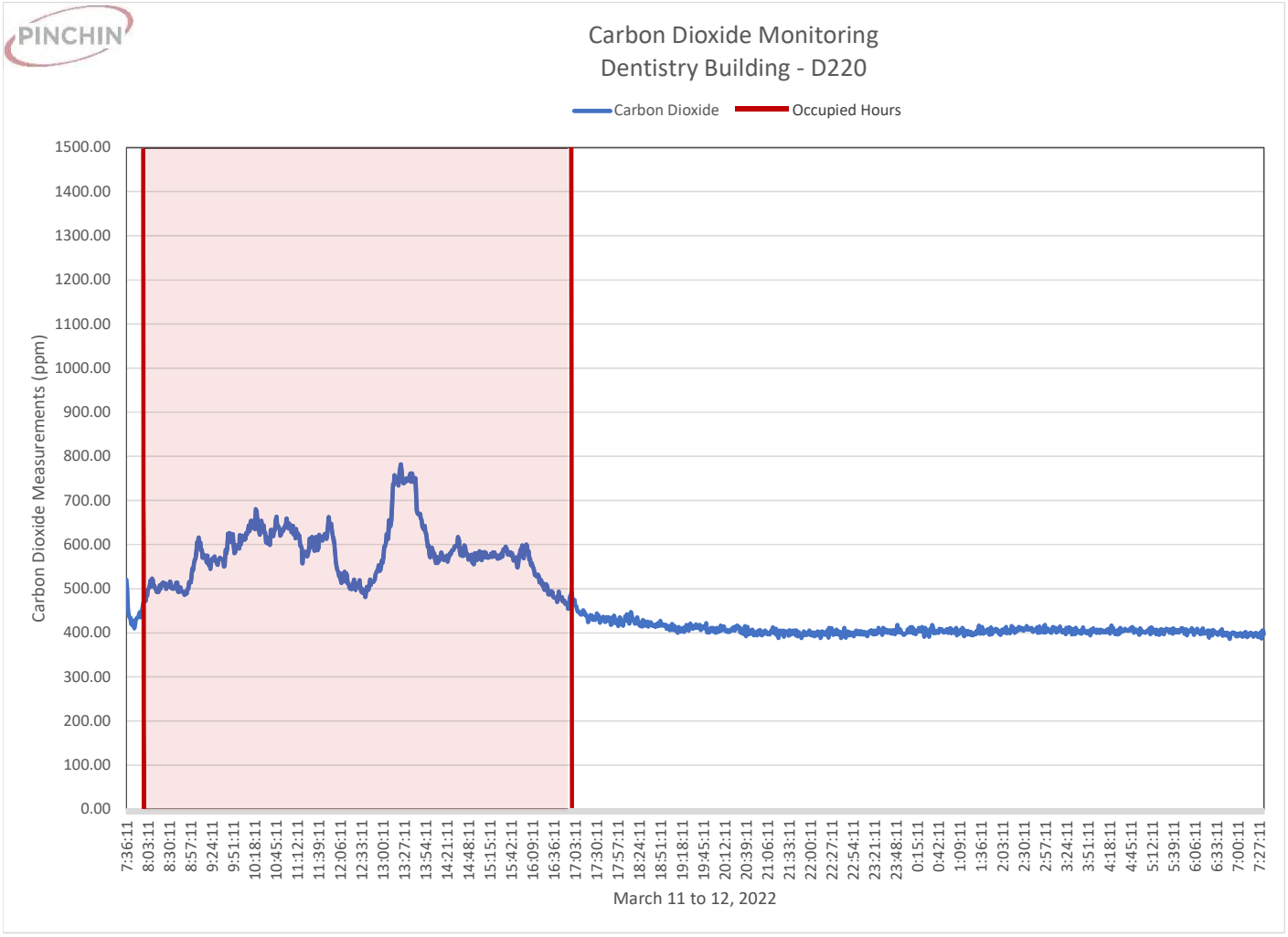
3/12/2022

Datalog Period

Device Name	EML090039
Serial Number	EML090039
Run Time	23:55:59
Start Time	3/11/2022 7:35:11 AM
Stop Time	3/12/2022 7:31:10 AM

IAQ Data Summary

Description	Value	Description	Value
CO2Ave	471 PPM	CO2Max	785 PPM
CO2MaxTime	3/11/2022 1:22:11 PM	CO2Min	385 PPM
COAve	0 PPM	COMax	0 PPM
COMin	0 PPM	Dust Average	1.000 ug/m³
Dust Max	57.000 ug/m³	Dust Min	0.000 ug/m³
Humidity Avg	4.3 %	Humidity Max	8.5 %
Humidity Max Time	3/11/2022 7:35:25 AM	Humidity Min	2.7 %
Humidity Min Time	3/12/2022 7:20:02 AM	PIDAvePPB	Below the Detection Limit of the Montoring Instrument
PIDMaxPPB	Below the Detection Limit of the Montoring Instrument	PIDMinPPB	Below the Detection Limit of the Montoring Instrument
Temp Avg	21 °C	Temp Max Time	3/11/2022 1:35:23 PM
Temp Min Time	3/11/2022 7:35:11 AM	Temperature Max	22.2 °C
Temperature Min	19 °C		
Dust Impactor Setting	2.5 µm		


PINCHIN
Carbon Dioxide Monitoring
Dentistry Building - D220
Carbon Dioxide
Occupied Hours
Carbon Dioxide Measurements (ppm)
1500.00
1400.00
1300.00
1200.00
1100.00
1000.00
900.00
800.00
700.00
600.00
500.00
400.00
300.00
200.00
100.00
0.00
7:36:11
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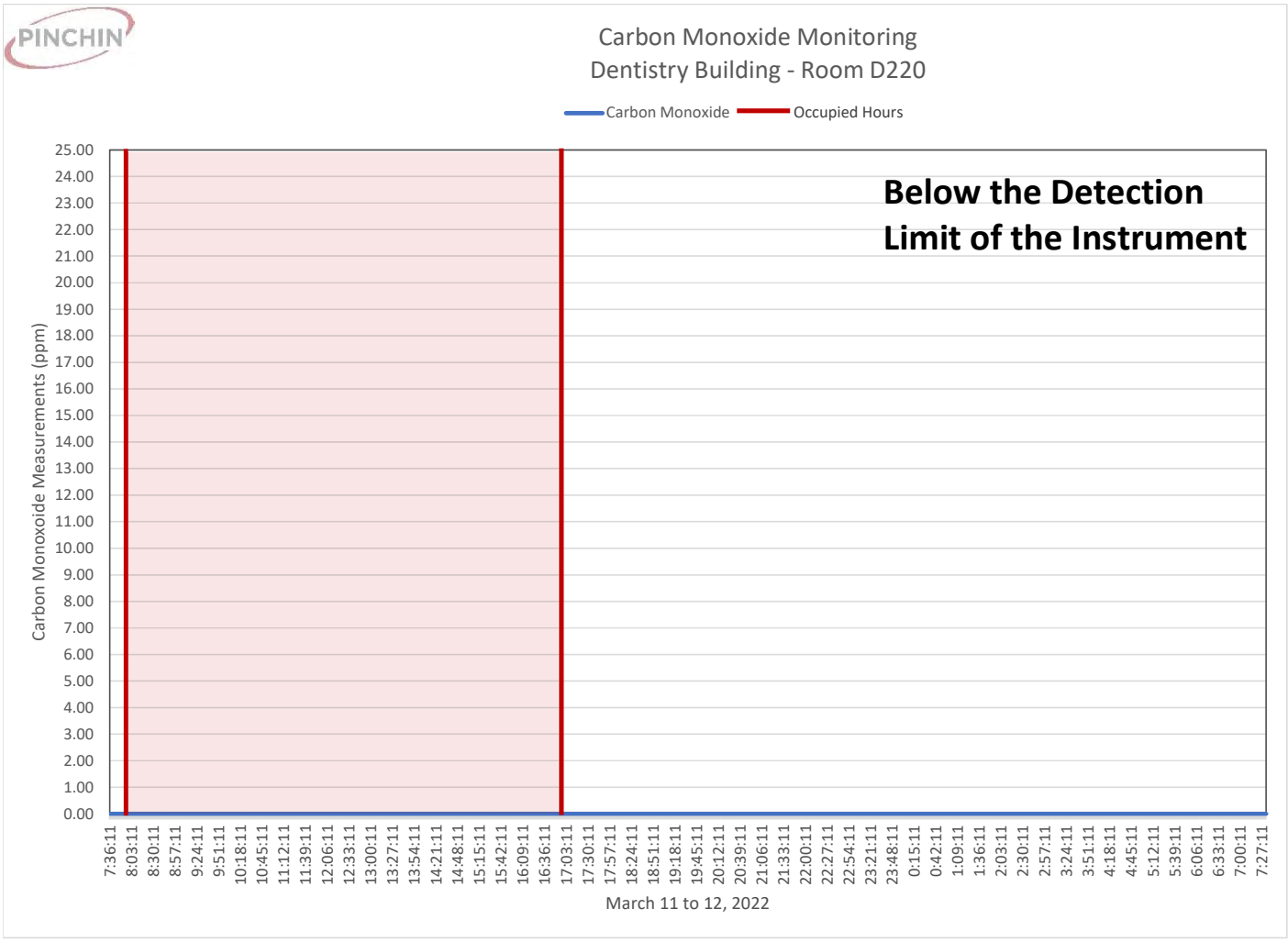
14:21:11
14:48:11
15:15:11
15:42:11
16:09:11
16:36:11
17:03:11
17:30:11
17:57:11
18:24:11
18:51:11
19:18:11
19:45:11
20:12:11
20:39:11
21:06:11
21:33:11
22:00:11
22:27:11
22:54:11
23:21:11
23:48:11
0:15:11
0:42:11
1:09:11
1:36:11
2:03:11
2:30:11
2:57:11
3:24:11
3:51:11
4:18:11
4:45:11
5:12:11
5:39:11
6:06:11
6:33:11
7:00:11
7:27:11
March 11 to 12, 2022


PINCHIN
Carbon Monoxide Monitoring
Dentistry Building - Room D220
Carbon Monoxide
Occupied Hours
Below the Detection Limit of the Instrument
Carbon Monoxide Measurements (ppm)
25.00
24.00
23.00
22.00
21.00
20.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
7:36:11
8:03:11
8:30:11
8:57:11
9:24:11
9:51:11
10:18:11
10:45:11
11:12:11
11:39:11
12:06:11
12:33:11
13:00:11
13:27:11
13:54:11
14:21:11
14:48:11
15:15:11
15:42:11
16:09:11
16:36:11
17:03:11
17:30:11
17:57:11
18:24:11
18:51:11
19:18:11
19:45:11
20:12:11
20:39:11
21:06:11
21:33:11
22:00:11
22:27:11
22:54:11
23:21:11
23:48:11
0:15:11
0:42:11
1:09:11
1:36:11
2:03:11
2:30:11
2:57:11
3:24:11
3:51:11
4:18:11
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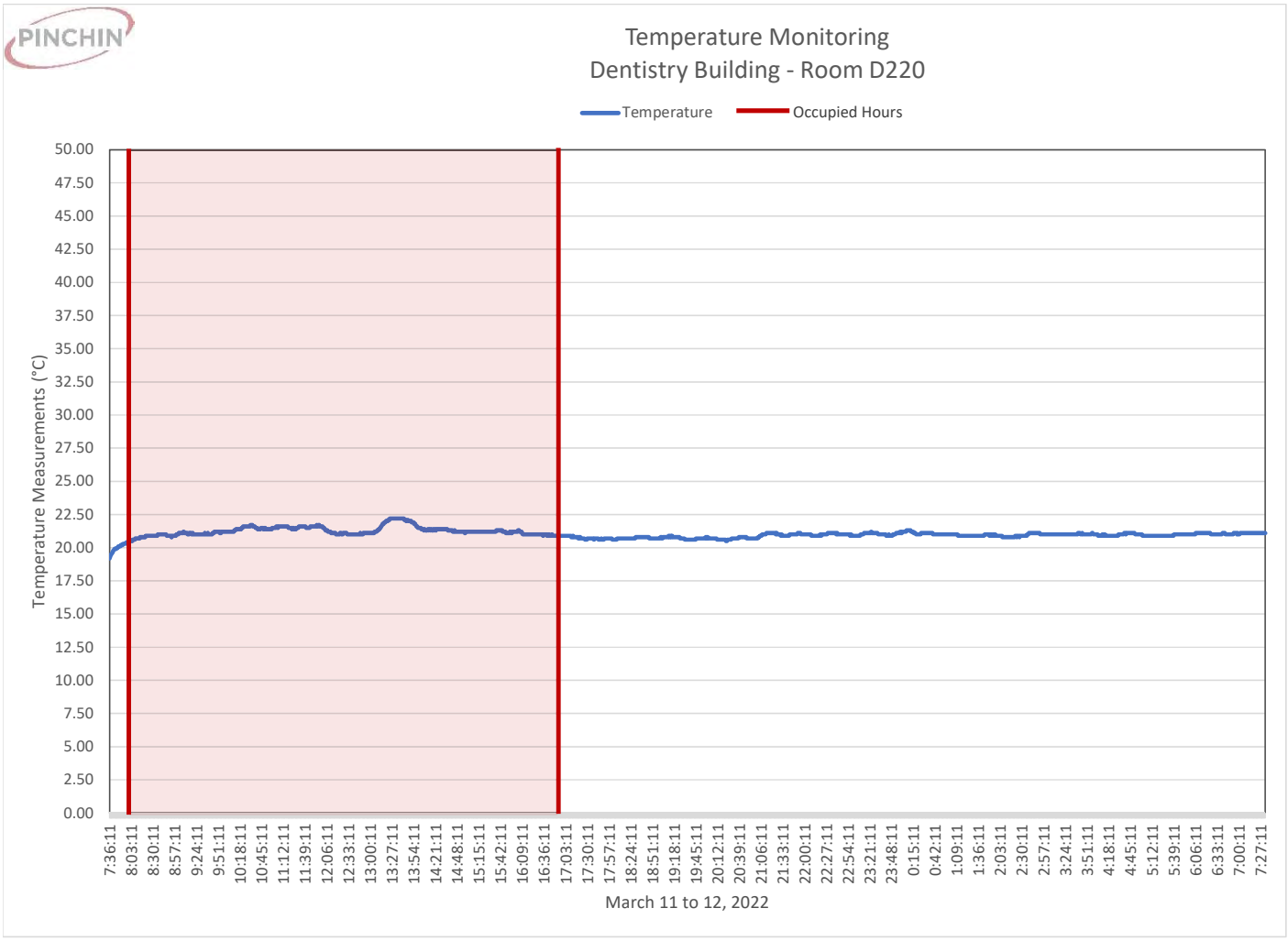
7:00:11
7:27:11
March 11 to 12, 2022


PINCHIN
Temperature Monitoring
Dentistry Building - Room D220
Temperature
Occupied Hours
Temperature Measurements (°C)
50.00
47.50
45.00
42.50
40.00
37.50
35.00
32.50
30.00
27.50
25.00
22.50
20.00
17.50
15.00
12.50
10.00
7.50
5.00
2.50
0.00
7:36:11
8:03:11
8:30:11
8:57:11
9:24:11
9:51:11
10:18:11
10:45:11
11:12:11
11:39:11
12:06:11
12:33:11
13:00:11
13:27:11
13:54:11
14:21:11
14:48:11
15:15:11
15:42:11
16:09:11
16:36:11
17:03:11
17:30:11
17:57:11
18:24:11
18:51:11
19:18:11
19:45:11
20:12:11
20:39:11
21:06:11
21:33:11
22:00:11
22:27:11
22:54:11
23:21:11
23:48:11
0:15:11
0:42:11
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1:36:11
2:03:11
2:30:11
2:57:11
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3:51:11
4:18:11
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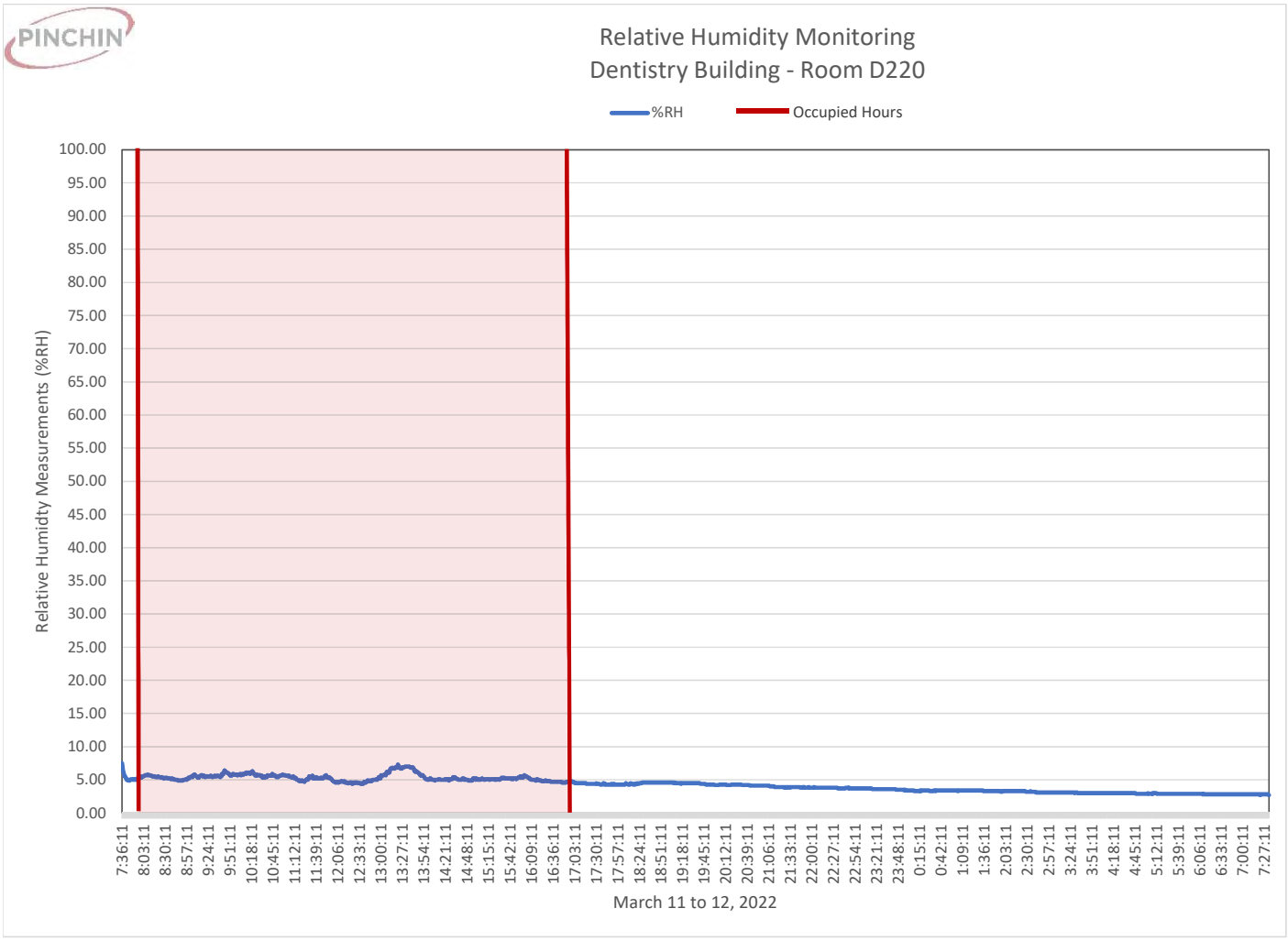
7:00:11
7:27:11
March 11 to 12, 2022


PINCHIN
Relative Humidity Monitoring
Dentistry Building - Room D220
%RH
Occupied Hours
Relative Humidty Measurements (%RH)
100.00
95.00
90.00
85.00
80.00
75.00
70.00
65.00
60.00
55.00
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
7:36:11
8:03:11
8:30:11
8:57:11
9:24:11
9:51:11
10:18:11
10:45:11
11:12:11
11:39:11
12:06:11
12:33:11
13:00:11
13:27:11
13:54:11
14:21:11
14:48:11
15:15:11
15:42:11
16:09:11
16:36:11
17:03:11
17:30:11
17:57:11
18:24:11
18:51:11
19:18:11
19:45:11
20:12:11
20:39:11
21:06:11
21:33:11
22:00:11
22:27:11
22:54:11
23:21:11
23:48:11
0:15:11
0:42:11
1:09:11
1:36:11
2:03:11
2:30:11
2:57:11
3:24:11
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4:18:11
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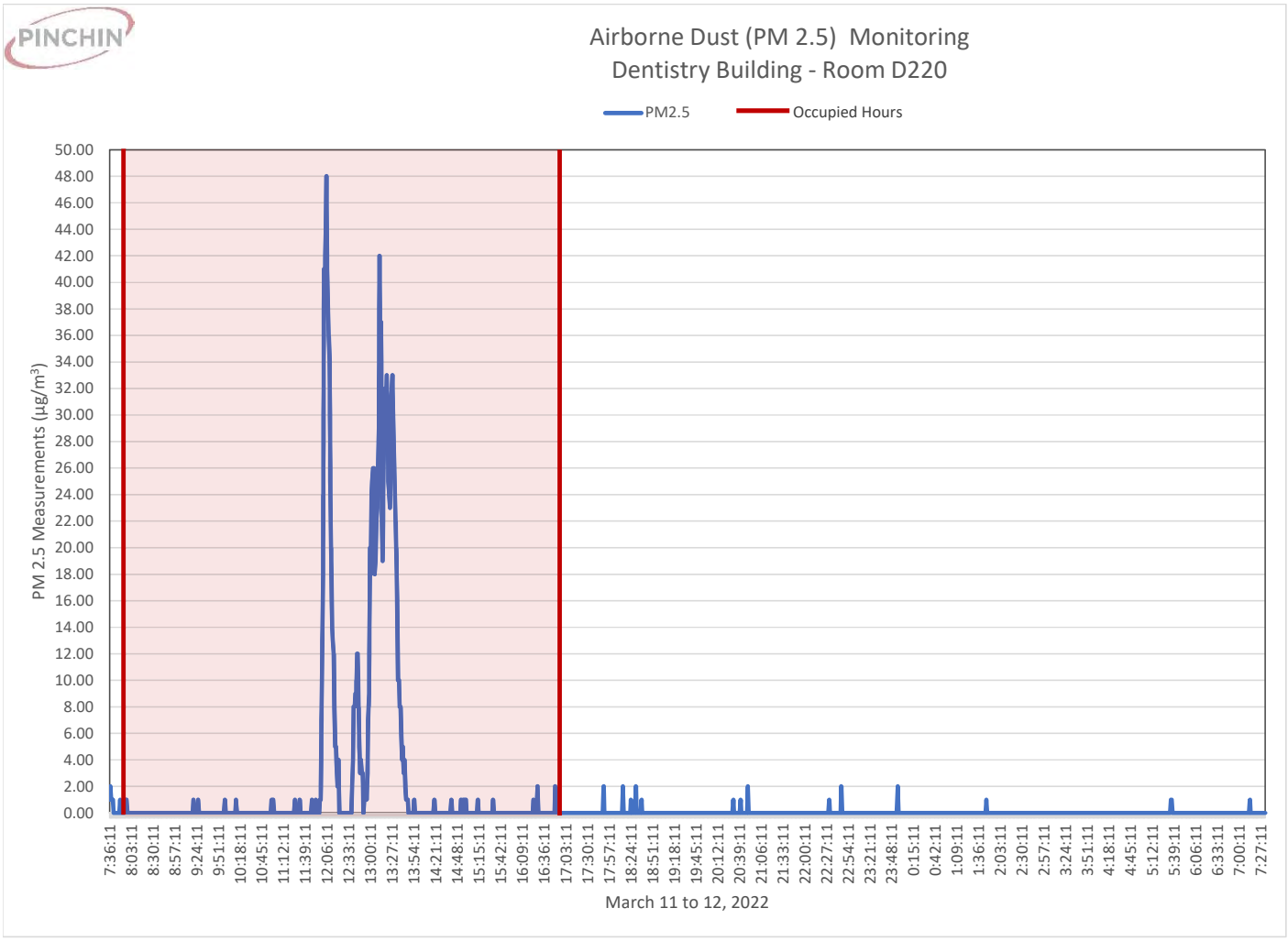
March 11 to 12, 2022


PINCHIN
Airborne Dust (PM 2.5) Monitoring
Dentistry Building - Room D220
PM2.5
Occupied Hours
PM 2.5 Measurements (µg/m³)
50.00
48.00
46.00
44.00
42.00
40.00
38.00
36.00
34.00
32.00
30.00
28.00
26.00
24.00
22.00
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
7:36:11
8:03:11
8:30:11
8:57:11
9:24:11
9:51:11
10:18:11
10:45:11
11:12:11
11:39:11
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12:33:11
13:00:11
13:27:11
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14:21:11
14:48:11
15:15:11
15:42:11
16:09:11
16:36:11
17:03:11
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17:57:11
18:24:11
18:51:11
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19:45:11
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2:57:11
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3:51:11
4:18:11
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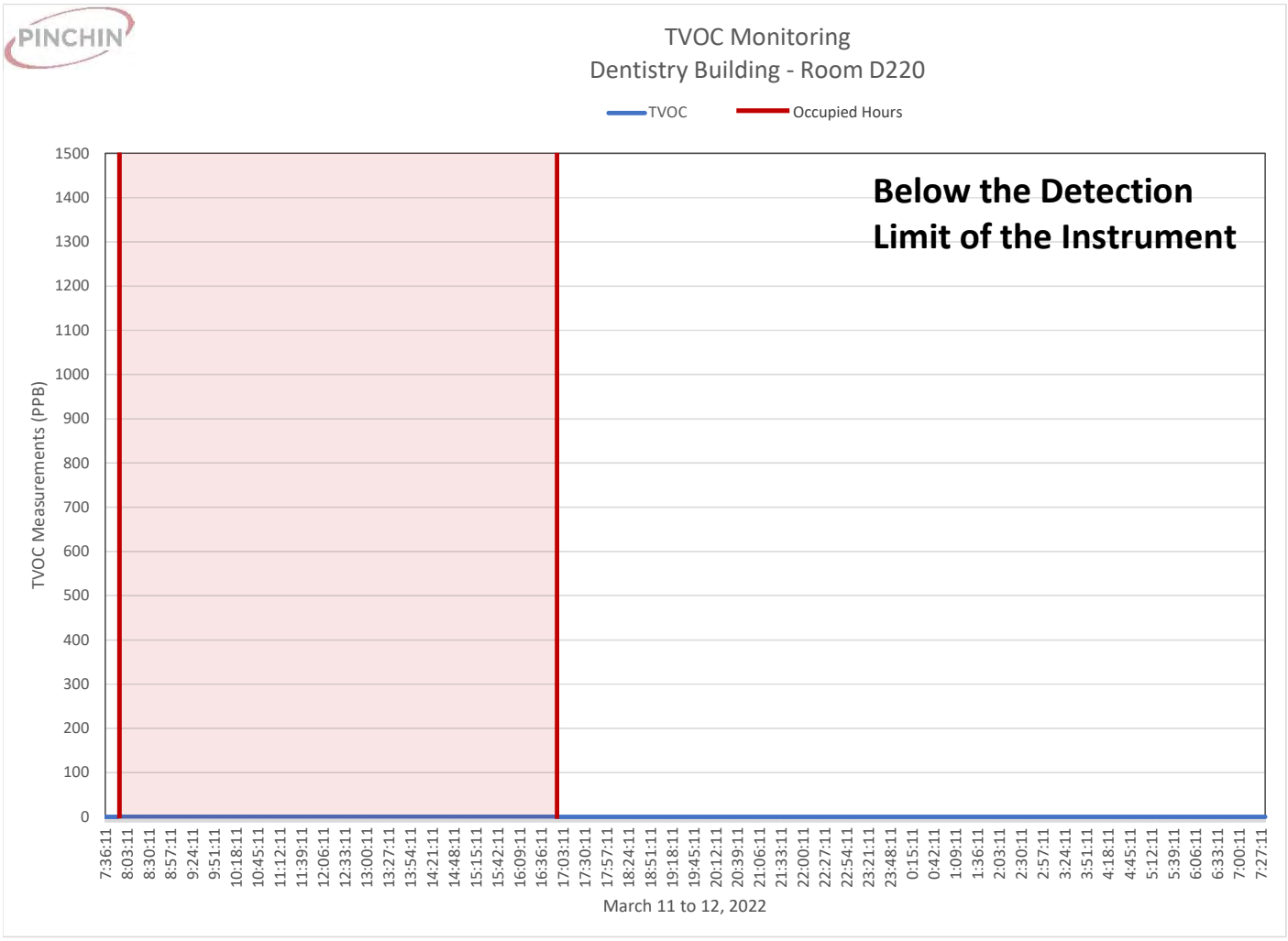
7:00:11
7:27:11
March 11 to 12, 2022


PINCHIN
TVOC Monitoring
Dentistry Building - Room D220
TVOC
Occupied Hours
Below the Detection Limit of the Instrument
TVOC Measurements (PPB)
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
7:36:11
8:03:11
8:30:11
8:57:11
9:24:11
9:51:11
10:18:11
10:45:11
11:12:11
11:39:11
12:06:11
12:33:11
13:00:11
13:27:11
13:54:11
14:21:11
14:48:11
15:15:11
15:42:11
16:09:11
16:36:11
17:03:11
17:30:11
17:57:11
18:24:11
18:51:11
19:18:11
19:45:11
20:12:11
20:39:11
21:06:11
21:33:11
22:00:11
22:27:11
22:54:11
23:21:11
23:48:11
0:15:11
0:42:11
1:09:11
1:36:11
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7:27:11
March 11 to 12, 2022

FINAL

Investigation of Indoor Air Quality

Medical Rehabilitation Building
771 McDermot Avenue, Winnipeg, Manitoba

Prepared for:

University of Manitoba
120 Physical Plant,
89 Freedman Crescent
Winnipeg, Manitoba, R3T 2N2

March 29, 2022

Pinchin File: 306866

Issued to: **University of Manitoba**
Issued on: **March 29, 2022**
Pinchin File: **306866**
Issuing Office: **Winnipeg, MB**

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EXECUTIVE SUMMARY

Pinchin Ltd. (Pinchin) was retained by University of Manitoba (the Client) to conduct an investigation of indoor air quality (IAQ) that included 24-hour data-log monitoring. The work was conducted at 771 McDermot Avenue, Winnipeg, Manitoba. Rooms R020 and R224 of the Medical Rehabilitation Building. The data logging locations were chosen by the client as Room R020 was occupied by staff and students during the hours of 08:00-10:00 and Room R224 was occupied during the hours of 08:00-17:00. Room R020 is located on the main floor, and R224 is located on Level 200 of the Medical Rehabilitation Building at the Bannatyne campus. The client also requested that in locations where the 24-hour monitoring occurred, observations be made specifically to the cleanliness of supply air diffusers and return air grilles.

Along with the 24-hour monitoring in Room R020 and R224, the client requested an inspection of the Heating Ventilation Air Conditioning (HVAC) system to determine if there were conditions present that could degrade air quality, i.e., dirty or wrongly fitted filters, presence of moisture, etc.

The majority of the indoor air quality measurements collected were within recommended ranges and meet the criteria of the referenced guidelines. Carbon Dioxide concentrations suggested adequate ventilation. Carbon Monoxide concentrations did not suggest the presence of exhaust or combustion gases. Temperature measurements were within the recommended comfort ranges for office environments. Particulate Matter $PM_{2.5}$ concentrations were within typical ranges. The Pinchin inspector did not identify any deficiencies with regards to unusual odours during the investigation.

Relative Humidity measurements were below the recommended comfort range which may result in dry skin, eye and nose irritation. However, it should be noted that low relative humidity is a common wintertime condition in Canada.

One water-stained ceiling tile was observed within Room R020, and three water stained ceiling tiles were observed within Room R224. Ceiling tiles can support mould growth if subjected to persistent wetting. The water-stained ceiling tiles should be removed and replaced ant the new ceiling tiles monitored for evidence of recurring leaks. If leaks reoccur then underlying repairs should made where necessary.

The following recommendations are offered to improve air quality in this building:

1. Communicate the findings of this report to the staff, and health and safety representative;
2. Review the humidification system in the building to ensure it is operational and functioning properly. Consider making adjustments as necessary; and
3. Remove and replace the water-stained ceiling tiles. Monitor the new ceiling tiles for any further staining. If water damage reoccurs the source of the damage should be identified and repaired.

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1.0 INTRODUCTION AND SCOPE

1.1 Statement of Understanding

Pinchin Ltd. (Pinchin) was retained by University of Manitoba (the Client) to conduct an investigation of indoor air quality (IAQ) that included 24-hour data-log monitoring. The work was conducted at 771 McDermot Avenue, Winnipeg, Manitoba. Rooms R020 and R224 of the Medical Rehabilitation Building were the data logging locations chosen by the client as Room R020 was occupied by staff and students during the hours of 08:00-10:00 and Room R224 was occupied during the hours of 08:00-17:00. Room R020 is located on the main floor, and R224 is located on Level 200 of the Medical Rehabilitation Building at the Bannatyne campus. The client also requested that in locations where the 24-hour monitoring occurred, observations be made specifically to the cleanliness of supply air diffusers and return air grilles. Along with the 24 hour monitoring in Room R020 and R224 the client requested an inspection of the Heating Ventilation Air Conditioning (HVAC) system to determine if there were conditions present that could degrade air quality, i.e., dirty or wrongly fitted filters, presence of moisture, etc.

1.2 Scope of Work

Pinchin performed the investigation on March 10 to March 11, 2022 for Room R020, and March 12 to March 13, 2022, for Room R224. The scope of this investigation was limited to Rooms R020, and R224.

The investigation involved the following activities:

- Walkthrough site reviews for factors that could degrade air quality;
- Site review of HVAC equipment servicing the entire building; AND
- 24 Hour Data-logging of Carbon Dioxide, Carbon Monoxide, Temperature, Relative Humidity (RH), Total Volatile Organic Compounds (TVOCs) and Particulate Matter smaller than 2.5 micrometres ($PM_{2.5}$) within Rooms R020, and R224.

2.0 METHODOLOGY

2.1 Interviews and Site Reviews

Pinchin interviewed the University of Manitoba Physical Plant, Project and Building Managers to discuss the history of the building, maintenance practices and any indoor air quality concerns.

The investigator did not perform any destructive work to inspect concealed conditions inside wall and/or ceiling cavities.

2.2 Test Methods and Criteria

The following table presents the parameters measured in this investigation, the instruments and sampling/analytical methods used, the applicable units of measurement, and the Indoor Air Quality criteria used for the evaluation of the results.

Table I – IAQ Parameters Tested, Measurement Criteria and Instruments

Parameter	Unit of Measurement	Recommended Limit	Instrumentation
Carbon dioxide, CO_2	Parts per million in air (ppm)	Outdoor Air (ppm) + 700 ppm[1]	24 hour Data-log Monitoring using a 3M® EVM-7 Air Quality Monitor
Carbon monoxide, CO	ppm	5 ppm[2]	
Temperature, T	°C	21 to 25 °C, winter clothing[3]	
Relative Humidity, RH	%RH	25[4] to 65[5] %, for occupant comfort	
Total Volatile Organic Compounds, (TVOC)	Parts per billion (ppb)	400 ppb [6]	
Particulate Matter smaller than 2.5 micrometres, $PM_{2.5}$	µg/m³	25 µg/m³ [7], 24-hour mean	24 hour Data-log Monitoring using an EVM-7 Air Quality Monitor

All data-logging direct-reading instruments were calibrated before use.

1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Ventilation for Acceptable Indoor Air Quality* [ANSI/ASHRAE Standard 62.1-2019]. Atlanta, GA: ASHRAE, 2019.
2 Health Canada: *Indoor Air Quality in Office Buildings: A Technical Guide*. Ottawa, ON: Health Canada, 1995.
3 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Thermal Environmental Conditions for Human Occupancy* [ANSI/ASHRAE Standard 55-2020]. Atlanta, GA: ASHRAE, 2020.
4 L.E. Burton, J.G. Girman, S.E. Womble: Airborne particulate matter within 100 randomly selected office buildings in the United States (BASE). Proceedings of Healthy Buildings 2000, Vol. 1 (2001).
5 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Thermal Environmental Conditions for Human Occupancy* [ANSI/ASHRAE Standard 55-2020]. Atlanta, GA:ASHRAE, 2020.
6 Value calculated from: US Environmental Protection Agency (EPA) "Building Assessment Survey and Evaluation (BASE) Study [Online] Available at http://www.epa.gov/iaq/base/summarized_data.html#Volatile_Organic_Compounds (Accessed August 25, 2014).
7 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Ventilation for Acceptable Indoor Air Quality* [ANSI/ASHRAE Standard 62.1-2019]. Atlanta, GA:ASHRAE, 2019.

3.0 FINDINGS

3.1 Results of Interviews

Project or Building Manager reported the following:

- Air Handling Units (AHU) filters are changed every three months or as needed;
- Occupant capacity for Rooms R020 and R224 is 50 people; and
- The enrollment/class for Rooms R020 and R224 is 25 people.

3.2 Facility Description

Table II – Facility Description

Item	Details
Construction Date	1955
Number of Floors	Three floors above grade, one floor below
Structural Type	Steel
Foundation Type	Concrete
Exterior Cladding	Brick
HVAC	Forced air
Roof	Built up
Flooring	Vinyl sheet flooring
Interior Walls	Drywall
Ceilings	Acoustic ceiling tile

3.3 Results of Site Reviews

Appendix I presents the drawings.

There is two Air Handling Units (AHUs) within the Medical Rehabilitation Building. AHU 1 provides conditioned air to the East side of the building (Photo #1). Inside the AHU there were no leaks or standing water (Photo #2) and the filters fit properly and were observed to be clear (Photo #3). AHU 1 condensate drain was free from leaks or standing water (Photo #4).

AHU 2 provides conditioned air to the West side of the building (Photo #5). Inside the AHU there were no leaks or standing water (Photo #6) and the filters fit properly and were observed to be clear (Photo #7). AHU 2 condensate drain was free from leaks or standing water (Photo #8).

In the sample location R020 there were observed to be four supply diffusers (Photo #9) and one return grate (Photo #10). In the sample location R224 there were observed to be four supply diffusers (Photo #11) and one return grate.

One water-stained ceiling tiles was observed within Room R020, and three water stained ceiling tiles were observed within Room R224 (Photo # 12-13).

The pre-filter size within the two AHUs are Minimum Efficiency Reporting Value (MERV) 11, the final filters are MERV 14 or better 6”-12”. The AHUs have 6 air changes per hour and a run time of 24-7. There is a humidification system and has a minimum fresh air component of 25% based on mixed air temperature.

Refer to Table III for photographs from the investigation.

Table III – Photographs from Investigation

Photo 1 - AHU 1

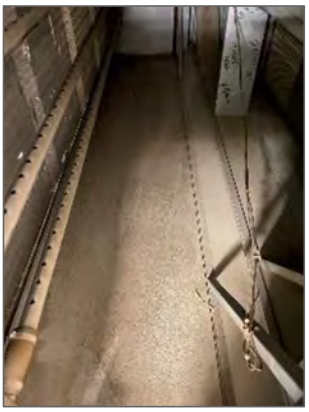


Photo 2 - Inside AHU 1 free from leaks or standing water

Photo 3 - AHU 1 filters (clean)

Photo 4 - AHU 1 condensate drain free from leaks or standing water

Table III – Photographs from Investigation

Photo 5 - AHU 2

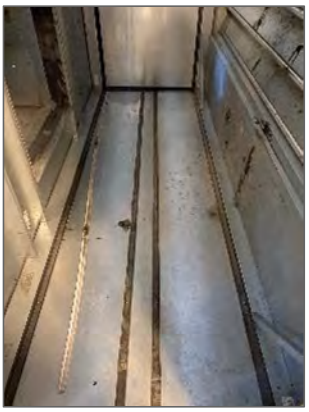


Photo 6 - Inside AHU 2 free from leaks or standing water

Photo 7 - AHU 2 filters (clean)

Photo 8 - AHU 2 condensate drain free from leaks or standing water

Photo 9 - Supply diffuser within Room R020

Photo 10 - Return Grate within Room R020

Table III – Photographs from Investigation

Photo 11 - Supply diffuser within Room R224

Photo 12 - Water-stained ceiling tile within Room R020

Photo 13 -Water-stained ceiling tile within Room R224

3.4 Results of Indoor Air Quality Tests

Appendix II presents the results of data-logging for IAQ parameters.

The EVM 7 air monitor was used for 24-hour monitoring within Room R020, and Room R224, of $PM_{2.5}$, CO_2, CO, TVOC, Temperature, and Relative Humidity. The EVM-7 is a direct-reading instrument and was calibrated before use.

3.4.1 Carbon Dioxide (CO_2)

The 24-hour minimum CO_2 concentration recorded within Room R020 was 453 ppm, the maximum CO_2 concentration was 761 ppm. The 24- hour average for CO_2 was 527 ppm. The average CO_2 concentration during **the occupied time** was 685 ppm. On March 10 and March 11 outdoor spot measurements were recorded. The average outdoor CO2 spot measurements for the two days was 436 ppm. The indoor Carbon Dioxide concentrations were below the limit of 1,110 ppm (410 ppm outdoors plus 700 ppm) recommended by American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) to provide indoor air quality acceptable to the majority of occupants. This indicates that the supply of outdoor air was adequate for the occupancy loading at the time of the investigation.

The 24-hour minimum CO_2 concentration recorded within Room R224 was 363 ppm, the maximum CO_2 concentration was 439 ppm. The 24- hour average for CO_2 was 387 ppm. The average CO_2 concentration during **the occupied time** was 393 ppm. On March 12 and March 13 outdoor spot measurements were recorded. The average outdoor CO2 spot measurements for the two days was 410 ppm. The indoor Carbon Dioxide concentrations were below the limit of 1,136 ppm (436 ppm outdoors plus 700 ppm) recommended by American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) to provide indoor air quality acceptable to the majority of occupants. This indicates that the supply of outdoor air was adequate for the occupancy loading at the time of the investigation.

3.4.2 Carbon Monoxide (CO)

The 24-hour minimum CO concentration within Room R020 was below the detection limit of the instrumentation, the maximum CO concentration was 1 ppm. The 24-hour average for CO was 0.01 ppm. The average CO concentration during **the occupied time** was 0.02 ppm. On March 10 and March 11 outdoor spot measurements were recorded. The average outdoor CO spot measurements for the two days was below the detection limit of the instrumentation.

The carbon monoxide concentrations were non-detectable or just at the detection limit of the instrumentation for the duration of the 24-hour monitoring in Room R224. Health Canada advises that the detection of carbon monoxide above 5 ppm indicates a concern requiring further investigation.

3.4.3 Temperature (Temp)

The 24-hour minimum Temperature measurement for Room R020 was 19.2 °C, the maximum Temperature measurement was 24.0 °C. The 24-hour average for Temperature measurement in Room R020 was 23.3 °C. The average Temperature measurements during **the occupied time** in Room R020 was 23.7 °C, On March 10 and March 11 outdoor spot measurements were taken each day. The average outdoor Temperature spot measurements for the two days was -20.5 °C.

The 24-hour minimum Temperature measurement for Room R224 was 19.0 °C, the maximum Temperature measurement was 24.2 °C. The 24-hour average for Temperature measurement in Room R224 was 23.6 °C. The average Temperature measurements during **the occupied time** in Room R224 was 23.2 °C, On March 12 and March 13 outdoor spot measurements were taken each day. The average outdoor Temperature spot measurements for the two days was -17.5 °C. The Temperatures were within the recommended comfort ranges for office environments for typical dress during winter conditions, of 21 to 25 °C

3.4.4 Relative Humidity (RH)

The 24-hour minimum Relative Humidity measurement for Room R020 was 2.3 %RH, the maximum Relative Humidity measurement was 6.8 %RH. The 24-hour average measurement for Relative Humidity averaged 4.4 %RH. The average Relative Humidity measurement during **the occupied time** was 3.8 %RH. On March 10 and March 11 outdoor spot measurements were taken each day. The average outdoor Relative Humidity spot measurements for the two days was 69 %RH.

The 24-hour minimum Relative Humidity measurement for Room R224 was 0.6 %RH, the maximum Relative Humidity measurement was 6.4 %RH. The 24-hour average measurement for Relative Humidity averaged 3.7 %RH. The average Relative Humidity measurements during **the occupied time** was 1.8 %RH. On March 12 and March 13 outdoor spot measurements were taken each day. The average outdoor Relative Humidity spot measurements for the two days was 67 %RH. Relative humidity below 25 %RH may result in complaints of dry skin and eye and nose irritation. Low relative humidity is a common winter time condition in Canada due to difficulties with humidification.

3.4.5 Particulate Matter ($PM_{2.5}$)

The 24-hour minimum concentration for $PM_{2.5}$ within Room R020 was 2 µg/m³, the maximum concentration for $PM_{2.5}$ was 12 µg/m³. The 24 hour average concentration for $PM_{2.5}$ was 3 µg/m³. The average $PM_{2.5}$ concentrations during **the occupied time** was 4 µg/m³. On March 10 and March 11 outdoor spot measurements were taken each day. The average outdoor $PM_{2.5}$ spot measurements for the two days was 23 µg/m³ .

The 24-hour minimum concentration for $PM_{2.5}$ within Room R020 was below the detection limits of the monitoring instrument, the maximum concentration for $PM_{2.5}$ was 3 µg/m³. The 24 hour average concentration for $PM_{2.5}$ was 0.01 µg/m³. The average $PM_{2.5}$ concentrations during **the occupied time** was below the detection limits of the monitoring instrument. On March 12 and March 13 outdoor spot measurements were taken each day. The average outdoor $PM_{2.5}$ spot measurements for the two days was 16 µg/m³ . For reference, World Health Organization (WHO) provides a guideline of 25 µg/m³ over a 24-hour period. The $PM_{2.5}$ concentrations in this building fell within the range typically measured in commercial buildings.

3.4.6 Total Volatile Organic Compounds (TVOC)

The TVOC concentrations were non-detectable or just at the detection limit of the instrumentation within Room R020 for the duration of the 24-hour monitoring.

The 24-hour minimum concentrations for TVOC within Room R224 was below the detection limits of the monitoring instrument, the maximum was 200 ppb. The 24-hour average for TVOCs was 0.1 ppb. The average TVOC concentrations during **the occupied time** was 0.4 ppb. On March 12 and March 12 outdoor spot measurements were taken and recorded as below the detection limit of the monitoring instrument for both dates. Based on US EPA research, office environments with TVOC concentrations up to about 400 ppb would be at little risk of IAQ complaint. Complaints might be expected if concentrations were significantly above 400 ppb.

Table IV – Summary of 24-Hour Data-logging IAQ based on Indoor Air Quality Criteria

Parameter	Measurement Average	Indoor Air Quality Measurement Criteria	Below Indoor Air Quality Measurement Criteria?
Carbon Dioxide	Room R020 527 ppm	Outdoor Air (ppm) + 700 ppm	Yes
	Room R224 387 ppm		
Carbon Monoxide	Room R020 0.01 ppm	5ppm	Yes
	Room R224 0 ppm		
Temperature (°C)	Room R020 23.3 °C	21 to 25 °C, winter clothing	Yes
	Room R224 23.6 °C		

Relative Humidity (%)	Room R020 4.4 %	25 to 65 %, for occupant comfort	No
	Room R224 3.7 %		
$PM_{2.5}$	Room R020 3 µg/m³	25 µg/m³	Yes
	Room R224 0.01 µg/m³		
TVOC	Room R020 **Below the Detection Limit of the Monitoring Instrument**	400 ppb	Yes
	Room R224 0.4 ppb		

4.0 DISCUSSION

The majority of the indoor air quality measurements collected were within recommended ranges and meet the criteria of the referenced guidelines. Carbon Dioxide concentrations suggested adequate ventilation. Carbon Monoxide concentrations did not suggest the presence of exhaust or combustion gases. Temperature measurements were within the recommended comfort ranges for office environments. Particulate Matter $PM_{2.5}$ concentrations were within typical ranges. The Pinchin inspector did not identify any deficiencies with regards to unusual odours during the investigation.

Relative Humidity measurements were below the recommended comfort range which may result in dry skin, eye and nose irritation. However, it should be noted that low relative humidity is a common wintertime condition in Canada.

One water-stained ceiling tile was observed within Room R020, and three water stained ceiling tiles were observed within Room R224. Ceiling tiles can support mould growth if subjected to persistent wetting. The water-stained ceiling tiles should be removed and replaced and the new ceiling tiles monitored for evidence of recurring leaks and underlying repairs should made where necessary.

5.0 RECOMMENDATIONS

Pinchin offers the following recommendations to improve air quality in this building.

1. Communicate the findings of this report to the staff, and health and safety representative;
2. Review the humidification system in the building to ensure it is operational and functioning properly. Consider making adjustments as necessary; and

3. Remove and replace the water-stained ceiling tiles. Monitor the new tiles for any further staining. If water damage reoccurs the source of the damage should be identified and repaired.

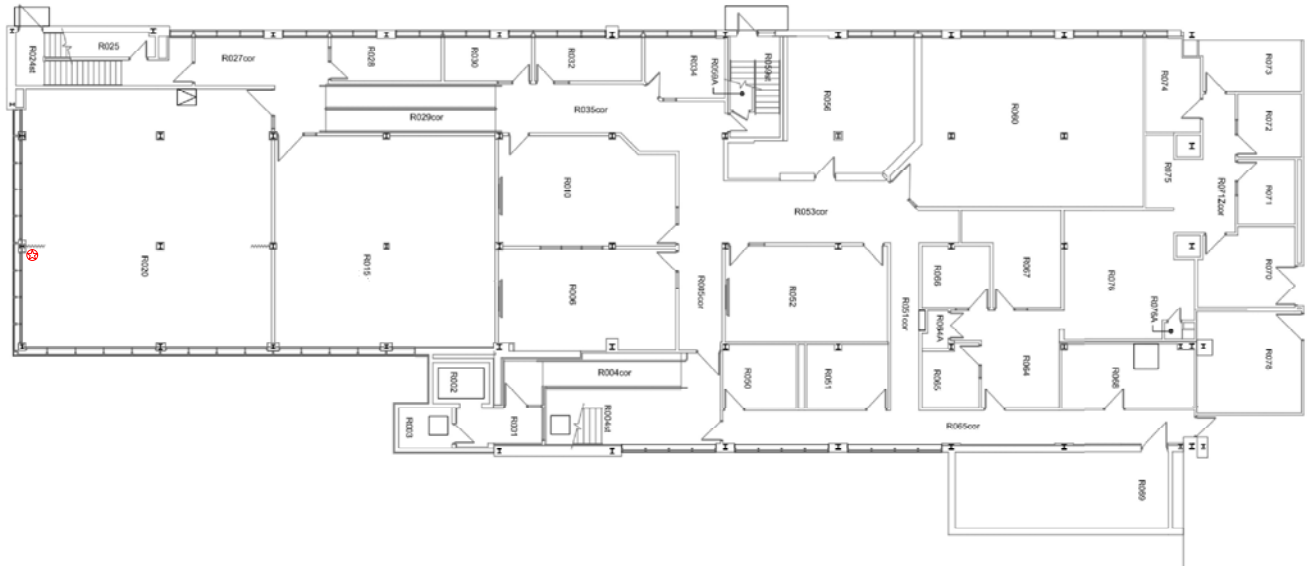
6.0 TERMS AND LIMITATIONS

This work was performed subject to the Terms and Limitations presented or referenced in the proposal for this project.

Information provided by Pinchin is intended for Client use only. Pinchin will not provide results or information to any party unless disclosure by Pinchin is required by law. Any use by a third party of reports or documents authored by Pinchin or any reliance by a third party on or decisions made by a third party based on the findings described in said documents, is the sole responsibility of such third parties. Pinchin accepts no responsibility for damages suffered by any third party as a result of decisions made or actions conducted. No other warranties are implied or expressed.

APPENDIX I

Drawings



N

LEGEND

DATA LOGGING LOCATION

BASE PLAN PROVIDED BY CLIENT.

PINCHIN

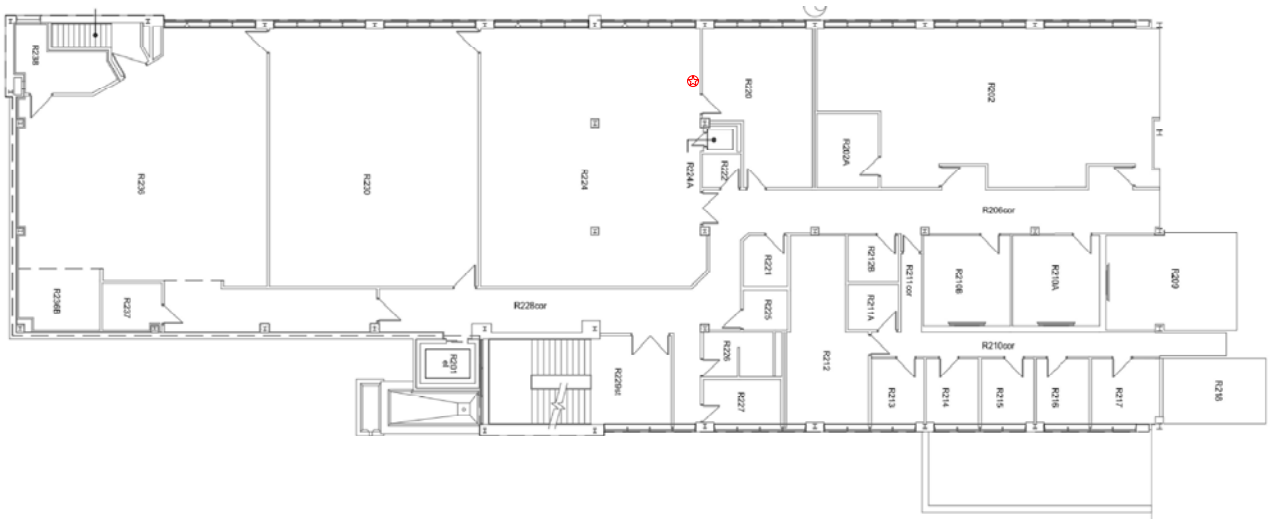
PROJECT NAME:
INDOOR AIR QUALITY ASSESSMENT

CLIENT NAME:
UNIVERSITY OF MANITOBA MEDICAL REHABILITATION

PROJECT LOCATION:
771 MCDERMOT AVENUE WINNIPEG, MANITOBA

FIGURE NAME:
LEVEL 000

PROJECT NUMBER:	SCALE:
306866	NOT TO SCALE
DRAWN BY:	REVIEWED BY:
CE	JB
DATE:	FIGURE NUMBER:
2022/03/28	1 OF 2



N

LEGEND

DATA LOGGING LOCATION

BASE PLAN PROVIDED BY CLIENT.

PINCHIN

PROJECT NAME:
INDOOR AIR QUALITY ASSESSMENT

CLIENT NAME:
UNIVERSITY OF MANITOBA MEDICAL REHIBILITATION

PROJECT LOCATION:
771 MCDERMOT AVENUE WINNIPEG, MANITOBA

FIGURE NAME:
LEVEL 200

PROJECT NUMBER:	SCALE:
306866	NOT TO SCALE
DRAWN BY:	REVIEWED BY:
CE	JB
DATE:	FIGURE NUMBER:
2022/03/28	2 OF 2

APPENDIX II

Results of Data-Logging Indoor Air Quality Measurements

Session Report
Medical Rehabilitation Building
Room R020

3/11/2022

Datalog Period

Device Name	EMI030004
Serial Number	EMI030004
Run Time	1.00:01:45
Start Time	3/10/2022 7:34:20 AM
Stop Time	3/11/2022 7:36:05 AM

IAQ Data Summary

Description	Value	Description	Value
CO2Ave	527 PPM	CO2Max	761 PPM
CO2MaxTime	3/10/2022 9:31:50 AM	CO2Min	453 PPM
COAve	0 PPM	COMax	1 PPM
COMin	0 PPM	Dust Average	3.000 ug/m³
Dust Max	12.000 ug/m³	Dust Min	2.000 ug/m³
Humidity Avg	4.4 %	Humidity Max	6.8 %
Humidity Max Time	3/10/2022 7:34:39 AM	Humidity Min	2.3 %
Humidity Min Time	3/10/2022 10:50:42 AM	PIDAvePPB	Below Detection Limit of Monitoring Instrument
PIDMaxPPB	Below Detection Limit of Monitoring Instrument	PIDMinPPB	Below Detection Limit of Monitoring Instrument
Temp Avg	23.3 °C	Temp Max Time	3/10/2022 9:36:38 AM
Temp Min Time	3/10/2022 7:34:19 AM	Temperature Max	24 °C
Temperature Min	19.2 °C		
Dust Impactor Setting	2.5 µm		

Session Report
Medical Rehabilitation Building
Room R224

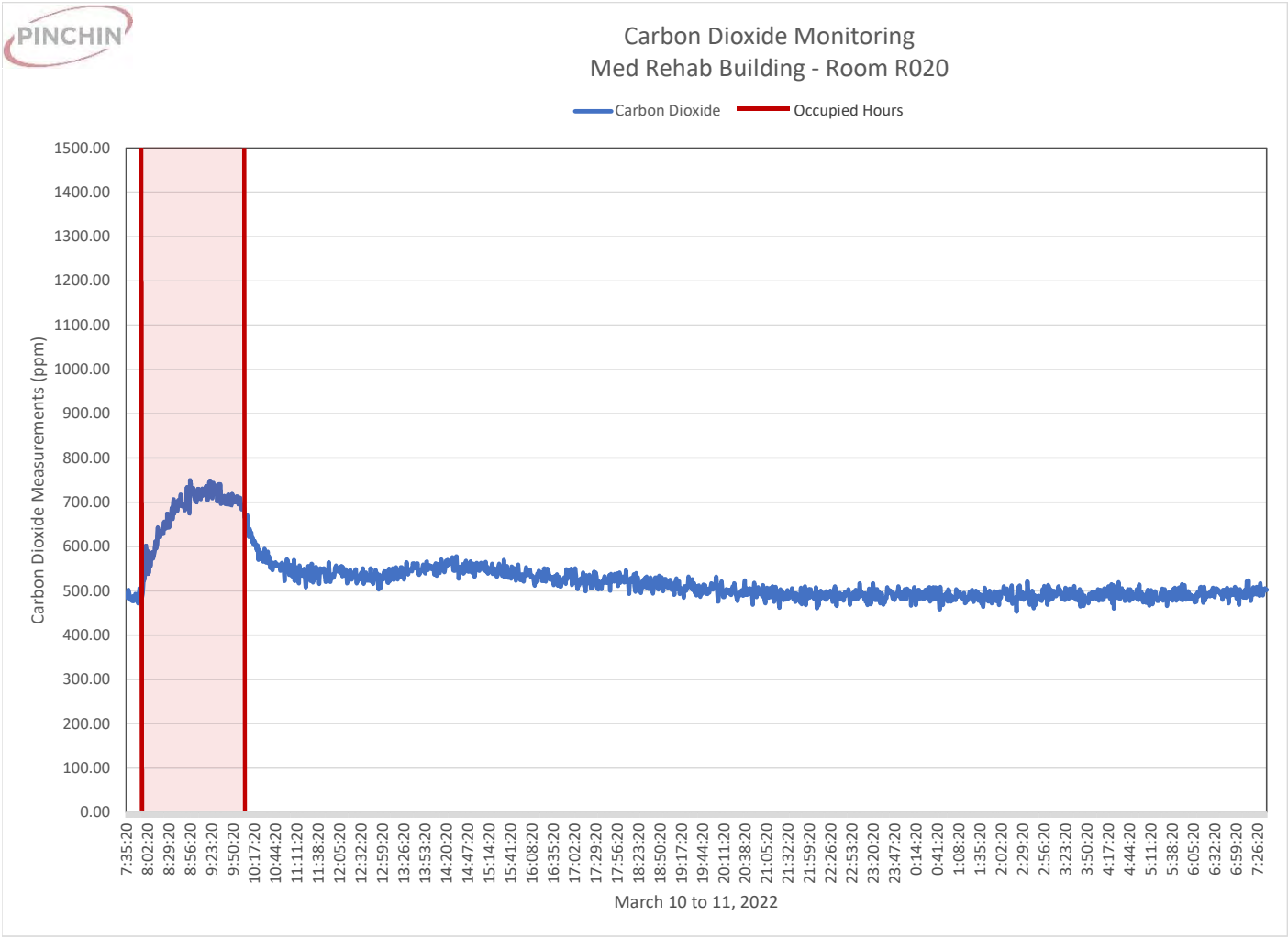
3/13/2022

Datalog Period

Device Name	EML090039
Serial Number	EML090039
Run Time	23:14:15
Start Time	3/12/2022 7:46:18 AM
Stop Time	3/13/2022 7:00:33 AM

IAQ Data Summary

Description	Value	Description	Value
CO2Ave	387 PPM	CO2Max	439 PPM
CO2MaxTime	3/12/2022 7:46:44 AM	CO2Min	363 PPM
COAve	0 PPM	COMax	1 PPM
COMin	0 PPM	Dust Average	0.000 ug/m³
Dust Max	3.000 ug/m³	Dust Min	0.000 ug/m³
Humidity Avg	3.7 %	Humidity Max	6.4 %
Humidity Max Time	3/12/2022 10:02:01 PM	Humidity Min	0.6 %
Humidity Min Time	3/12/2022 9:07:03 AM	PIDAvePPB	0.4 PPB
PIDMaxPPB	200 PPB	PIDMinPPB	Below Detection Limit of Monitoring Instrument
Temp Avg	23.6 °C	Temp Max Time	3/13/2022 12:28:21 AM
Temp Min Time	3/12/2022 7:46:18 AM	Temperature Max	24.2 °C
Temperature Min	19 °C		
Dust Impactor Setting	2.5 µm		


PINCHIN
Carbon Dioxide Monitoring
Med Rehab Building - Room R020
Carbon Dioxide
Occupied Hours
Carbon Dioxide Measurements (ppm)
1500.00
1400.00
1300.00
1200.00
1100.00
1000.00
900.00
800.00
700.00
600.00
500.00
400.00
300.00
200.00
100.00
0.00
7:35:20
8:02:20
8:29:20
8:56:20
9:23:20
9:50:20
10:17:20
10:44:20
11:11:20
11:38:20
12:05:20
12:32:20
12:59:20
13:26:20
13:53:20
14:20:20
14:47:20
15:14:20
15:41:20
16:08:20
16:35:20
17:02:20
17:29:20
17:56:20
18:23:20
18:50:20
19:17:20
19:44:20
20:11:20
20:38:20
21:05:20
21:32:20
21:59:20
22:26:20
22:53:20
23:20:20
23:47:20
0:14:20
0:41:20
1:08:20
1:35:20
2:02:20
2:29:20
2:56:20
3:23:20
3:50:20
4:17:20
4:44:20
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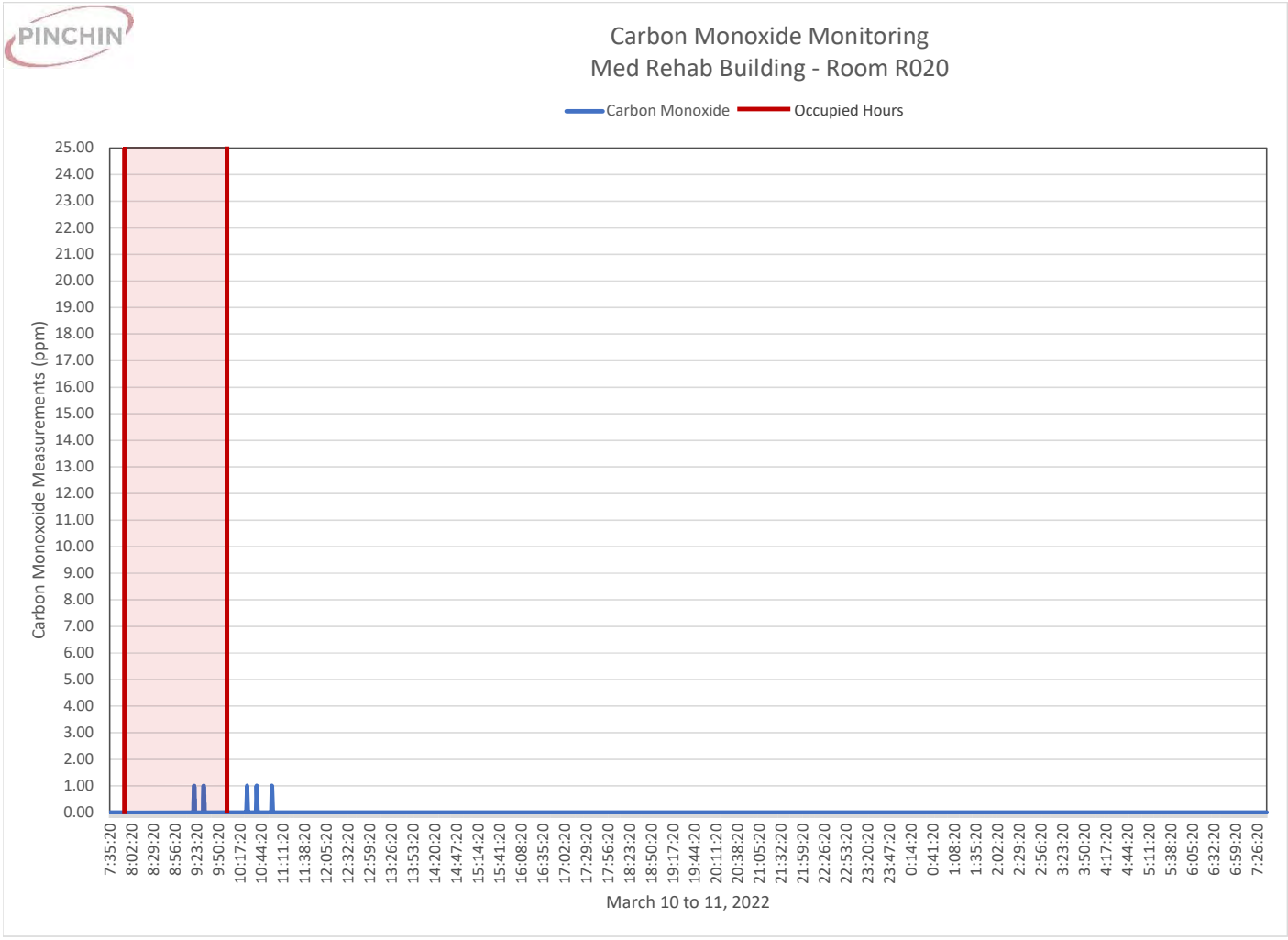
5:38:20
6:05:20
6:32:20
6:59:20
7:26:20
March 10 to 11, 2022


PINCHIN
Carbon Monoxide Monitoring
Med Rehab Building - Room R020
Carbon Monoxide
Occupied Hours
Carbon Monoxide Measurements (ppm)
25.00
24.00
23.00
22.00
21.00
20.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
7:35:20
8:02:20
8:29:20
8:56:20
9:23:20
9:50:20
10:17:20
10:44:20
11:11:20
11:38:20
12:05:20
12:32:20
12:59:20
13:26:20
13:53:20
14:20:20
14:47:20
15:14:20
15:41:20
16:08:20
16:35:20
17:02:20
17:29:20
17:56:20
18:23:20
18:50:20
19:17:20
19:44:20
20:11:20
20:38:20
21:05:20
21:32:20
21:59:20
22:26:20
22:53:20
23:20:20
23:47:20
0:14:20
0:41:20
1:08:20
1:35:20
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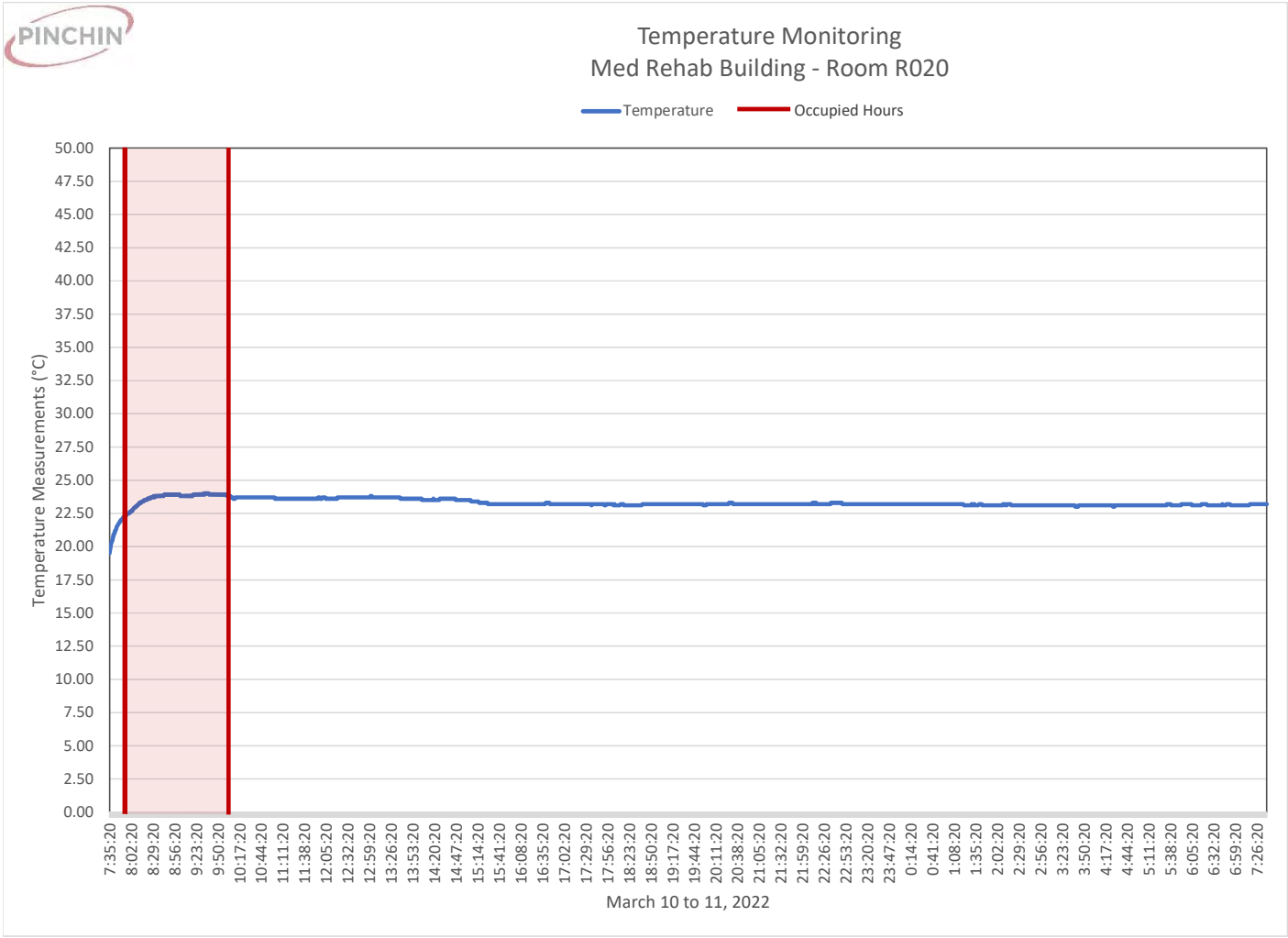
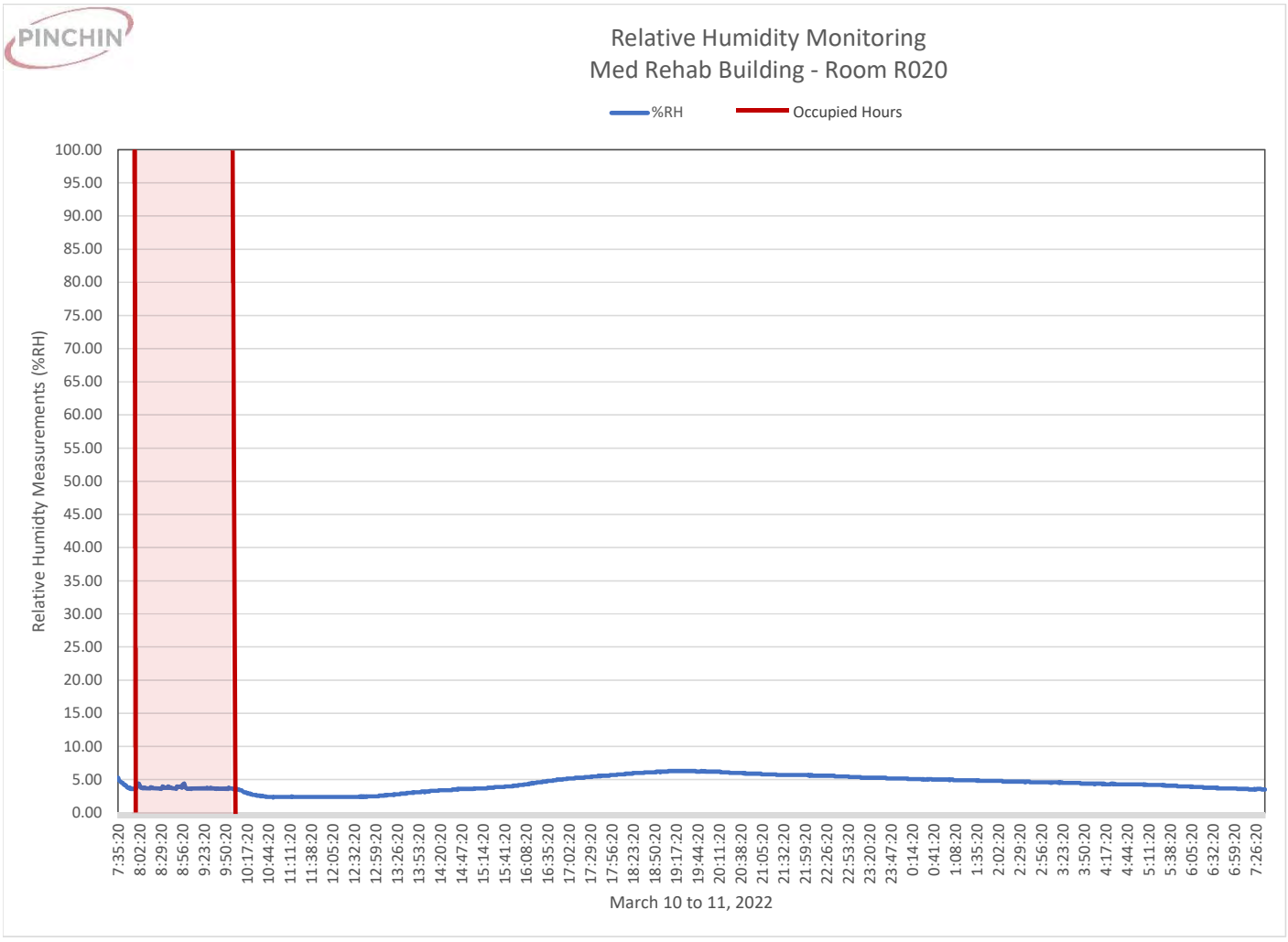
2:29:20
2:56:20
3:23:20
3:50:20
4:17:20
4:44:20
5:11:20
5:38:20
6:05:20
6:32:20
6:59:20
7:26:20
March 10 to 11, 2022


PINCHIN
Temperature Monitoring
Med Rehab Building - Room R020
Temperature
Occupied Hours
Temperature Measurements (°C)
50.00
47.50
45.00
42.50
40.00
37.50
35.00
32.50
30.00
27.50
25.00
22.50
20.00
17.50
15.00
12.50
10.00
7.50
5.00
2.50
0.00
7:35:20
8:02:20
8:29:20
8:56:20
9:23:20
9:50:20
10:17:20
10:44:20
11:11:20
11:38:20
12:05:20
12:32:20
12:59:20
13:26:20
13:53:20
14:20:20
14:47:20
15:14:20
15:41:20
16:08:20
16:35:20
17:02:20
17:29:20
17:56:20
18:23:20
18:50:20
19:17:20
19:44:20
20:11:20
20:38:20
21:05:20
21:32:20
21:59:20
22:26:20
22:53:20
23:20:20
23:47:20
0:14:20
0:41:20
1:08:20
1:35:20
2:02:20
2:29:20
2:56:20
3:23:20
3:50:20
4:17:20
4:44:20
5:11:20
5:38:20
6:05:20
6:32:20
6:59:20
7:26:20
March 10 to 11, 2022


PINCHIN
Relative Humidity Monitoring
Med Rehab Building - Room R020
%RH
Occupied Hours
Relative Humidty Measurements (%RH)
100.00
95.00
90.00
85.00
80.00
75.00
70.00
65.00
60.00
55.00
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
7:35:20
8:02:20
8:29:20
8:56:20
9:23:20
9:50:20
10:17:20
10:44:20
11:11:20
11:38:20
12:05:20
12:32:20
12:59:20
13:26:20
13:53:20
14:20:20
14:47:20
15:14:20
15:41:20
16:08:20
16:35:20
17:02:20
17:29:20
17:56:20
18:23:20
18:50:20
19:17:20
19:44:20
20:11:20
20:38:20
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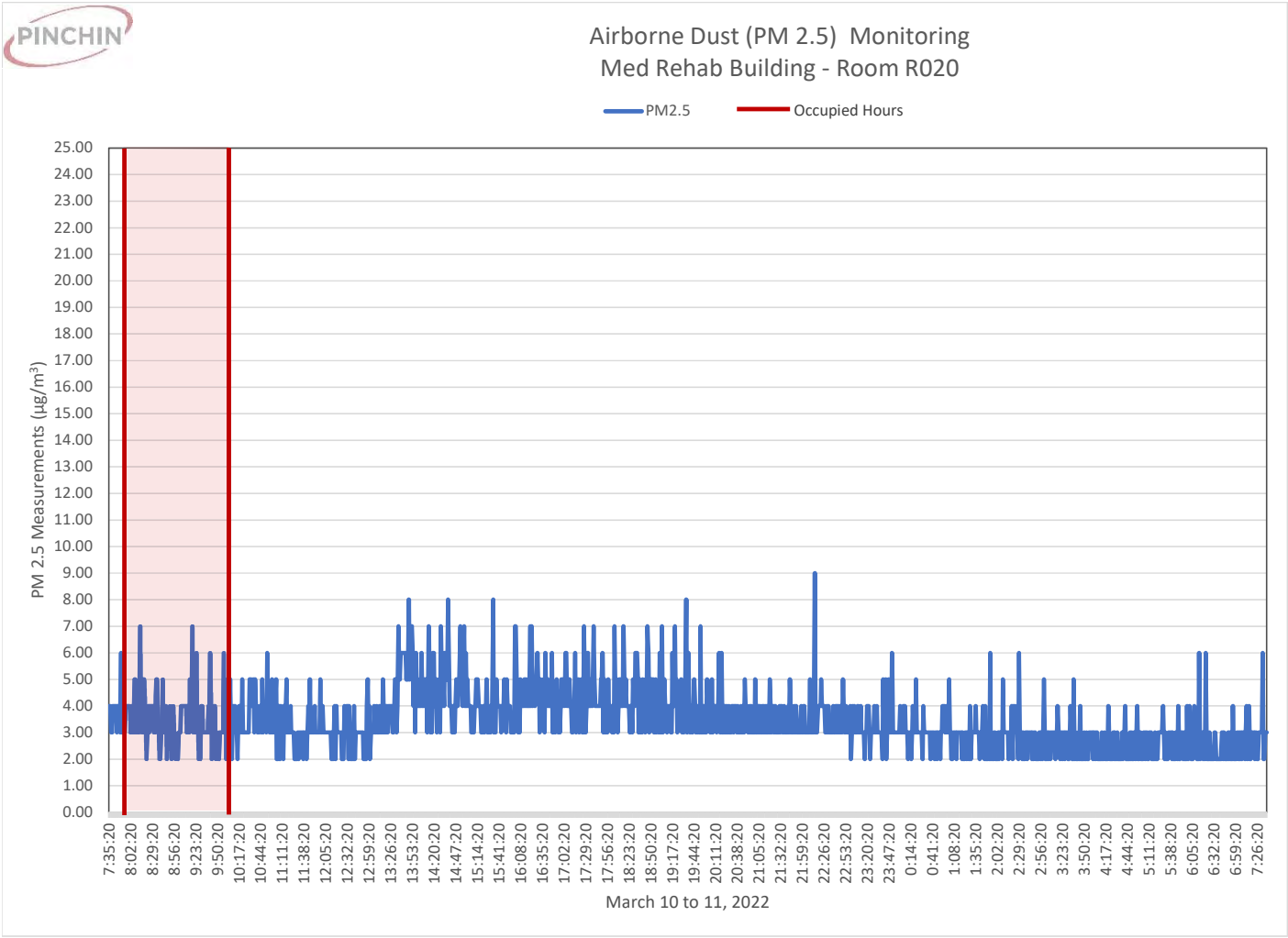
22:53:20
23:20:20
23:47:20
0:14:20
0:41:20
1:08:20
1:35:20
2:02:20
2:29:20
2:56:20
3:23:20
3:50:20
4:17:20
4:44:20
5:11:20
5:38:20
6:05:20
6:32:20
6:59:20
7:26:20
March 10 to 11, 2022


PINCHIN
Airborne Dust (PM 2.5) Monitoring
Med Rehab Building - Room R020
PM2.5
Occupied Hours
PM 2.5 Measurements (µg/m³)
25.00
24.00
23.00
22.00
21.00
20.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
7:35:20
8:02:20
8:29:20
8:56:20
9:23:20
9:50:20
10:17:20
10:44:20
11:11:20
11:38:20
12:05:20
12:32:20
12:59:20
13:26:20
13:53:20
14:20:20
14:47:20
15:14:20
15:41:20
16:08:20
16:35:20
17:02:20
17:29:20
17:56:20
18:23:20
18:50:20
19:17:20
19:44:20
20:11:20
20:38:20
21:05:20
21:32:20
21:59:20
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3:50:20
4:17:20
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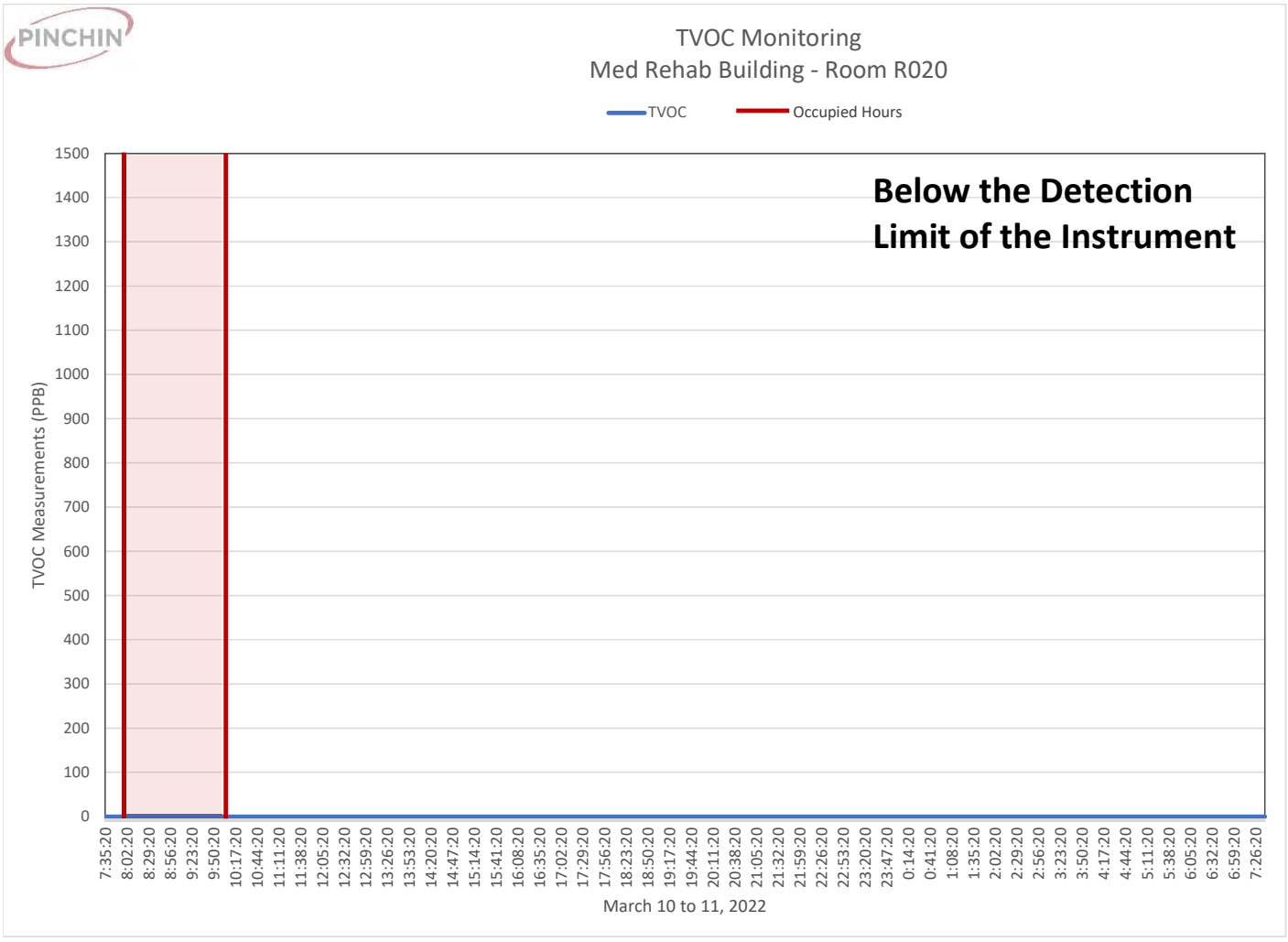
6:59:20
7:26:20
March 10 to 11, 2022


PINCHIN
TVOC Monitoring
Med Rehab Building - Room R020
TVOC
Occupied Hours
Below the Detection Limit of the Instrument
TVOC Measurements (PPB)
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
7:35:20
8:02:20
8:29:20
8:56:20
9:23:20
9:50:20
10:17:20
10:44:20
11:11:20
11:38:20
12:05:20
12:32:20
12:59:20
13:26:20
13:53:20
14:20:20
14:47:20
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15:41:20
16:08:20
16:35:20
17:02:20
17:29:20
17:56:20
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3:50:20
4:17:20
4:44:20
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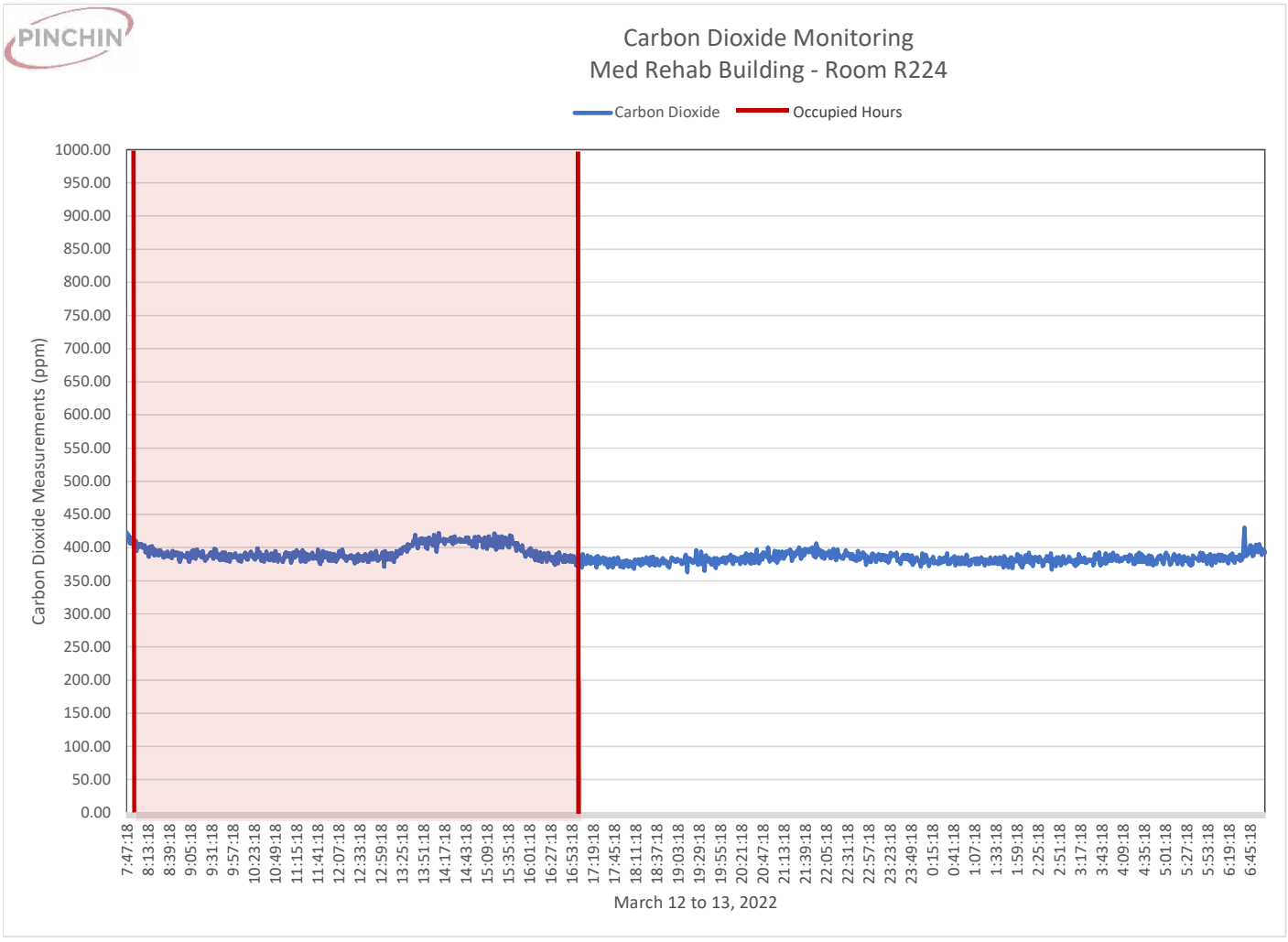
5:38:20
6:05:20
6:32:20
6:59:20
7:26:20
March 10 to 11, 2022


PINCHIN
Carbon Dioxide Monitoring
Med Rehab Building - Room R224
Carbon Dioxide
Occupied Hours
Carbon Dioxide Measurements (ppm)
1000.00
950.00
900.00
850.00
800.00
750.00
700.00
650.00
600.00
550.00
500.00
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
7:47:18
8:13:18
8:39:18
9:05:18
9:31:18
9:57:18
10:23:18
10:49:18
11:15:18
11:41:18
12:07:18
12:33:18
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13:25:18
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15:09:18
15:35:18
16:01:18
16:27:18
16:53:18
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17:45:18
18:11:18
18:37:18
19:03:18
19:29:18
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21:39:18
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22:31:18
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1:07:18
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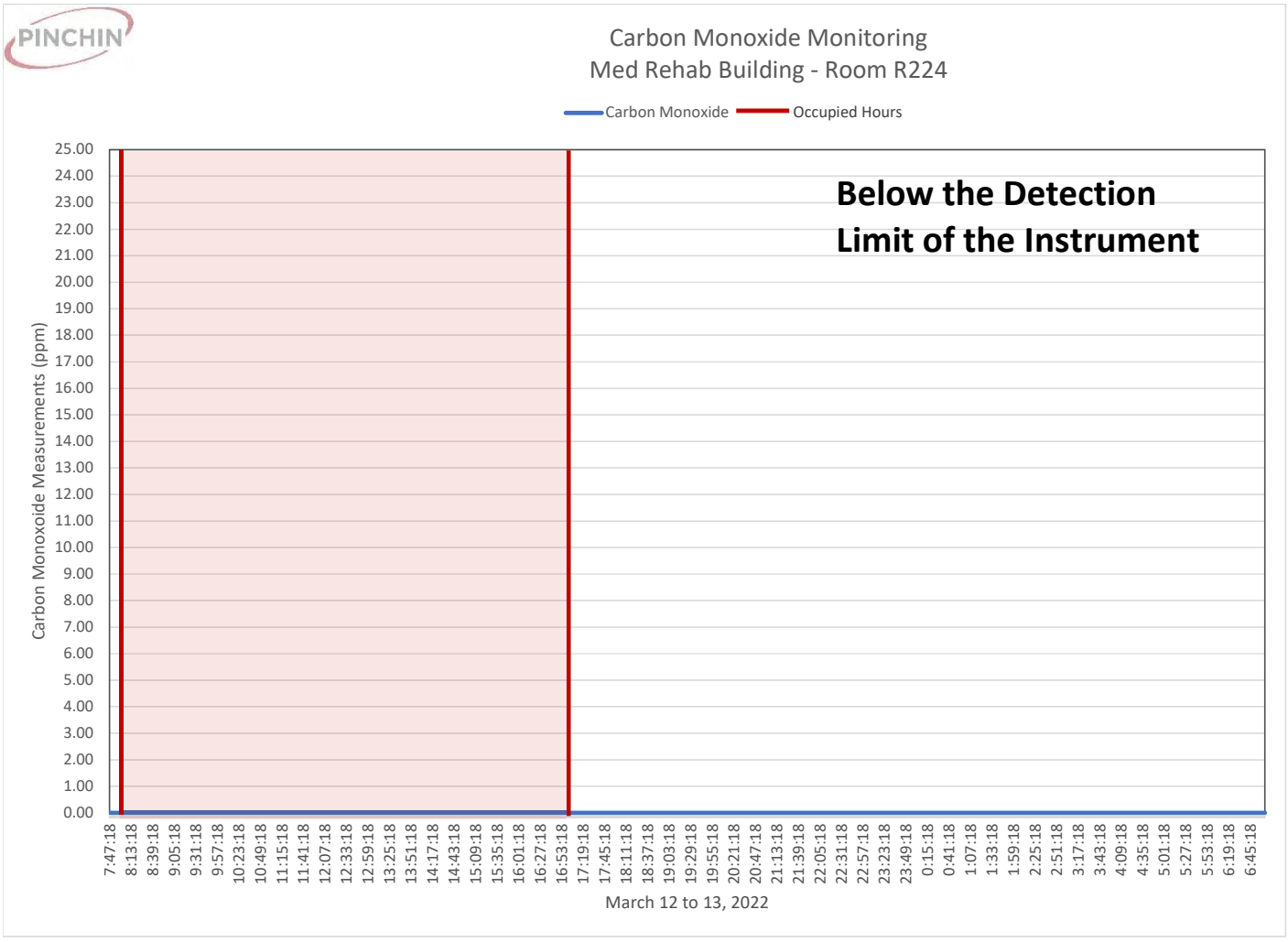
3:17:18
3:43:18
4:09:18
4:35:18
5:01:18
5:27:18
5:53:18
6:19:18
6:45:18
March 12 to 13, 2022


PINCHIN
Carbon Monoxide Monitoring
Med Rehab Building - Room R224
Carbon Monoxide
Occupied Hours
Below the Detection Limit of the Instrument
Carbon Monoxide Measurements (ppm)
25.00
24.00
23.00
22.00
21.00
20.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
7:47:18
8:13:18
8:39:18
9:05:18
9:31:18
9:57:18
10:23:18
10:49:18
11:15:18
11:41:18
12:07:18
12:33:18
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13:25:18
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16:53:18
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3:17:18
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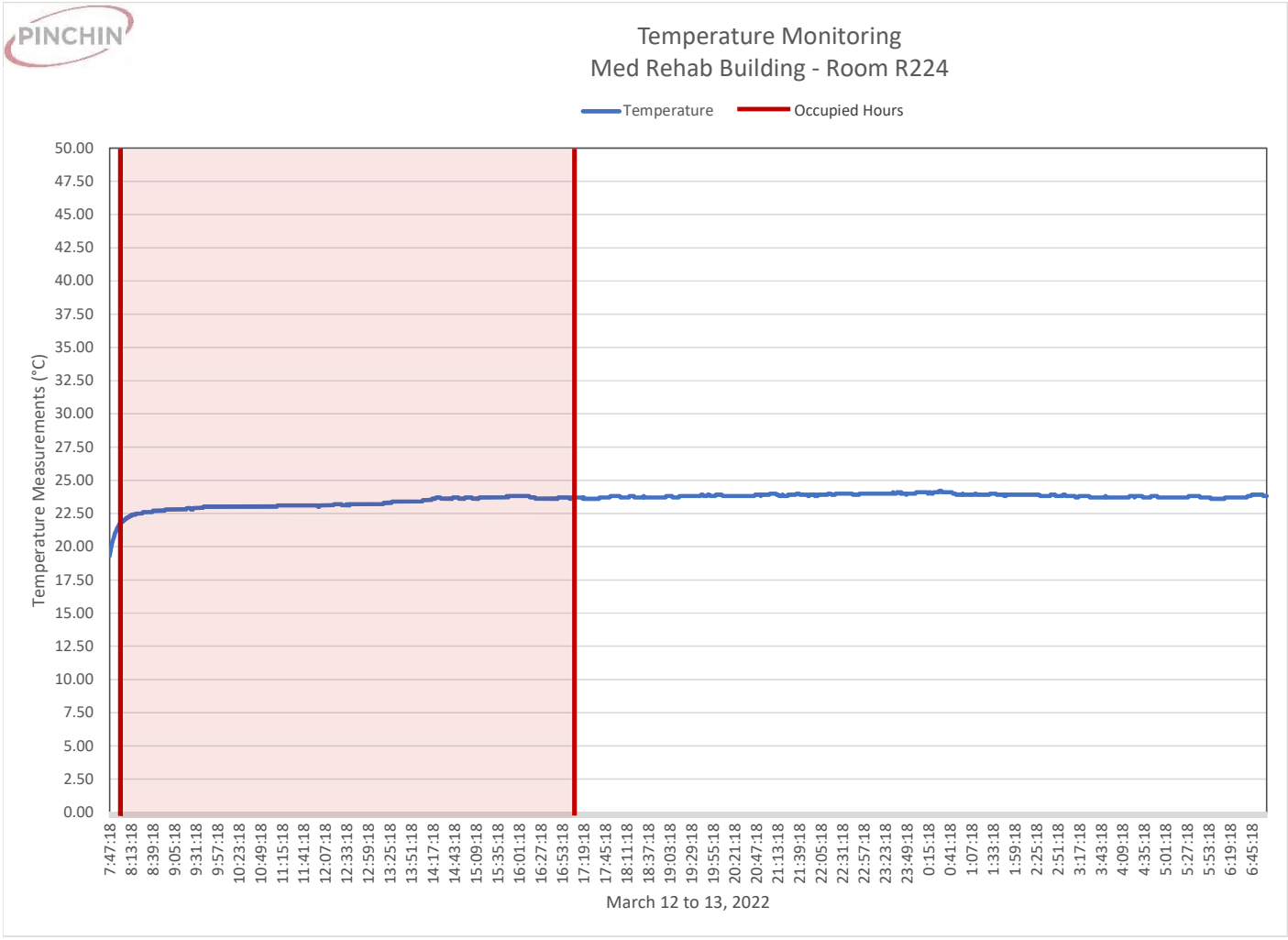
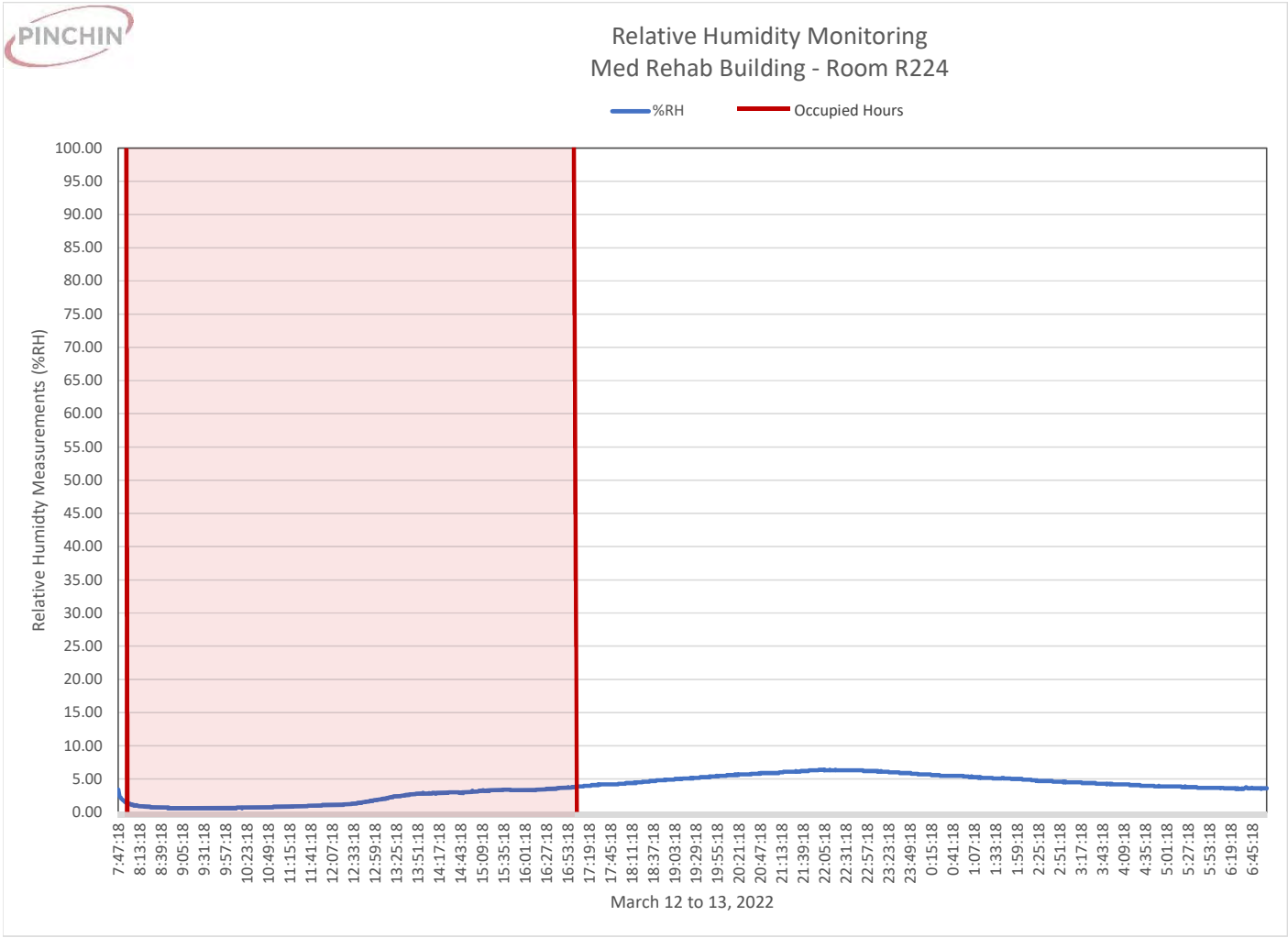
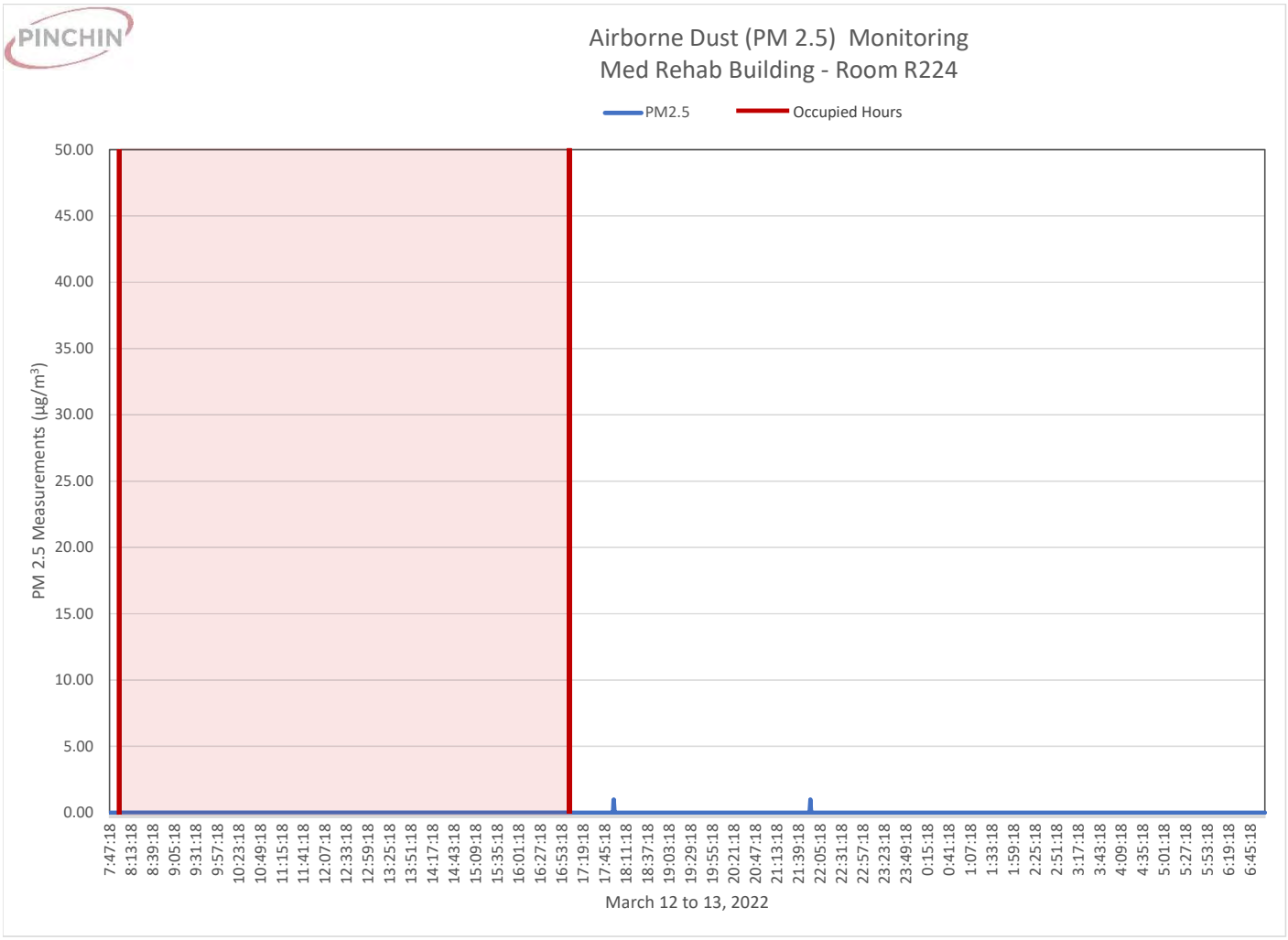
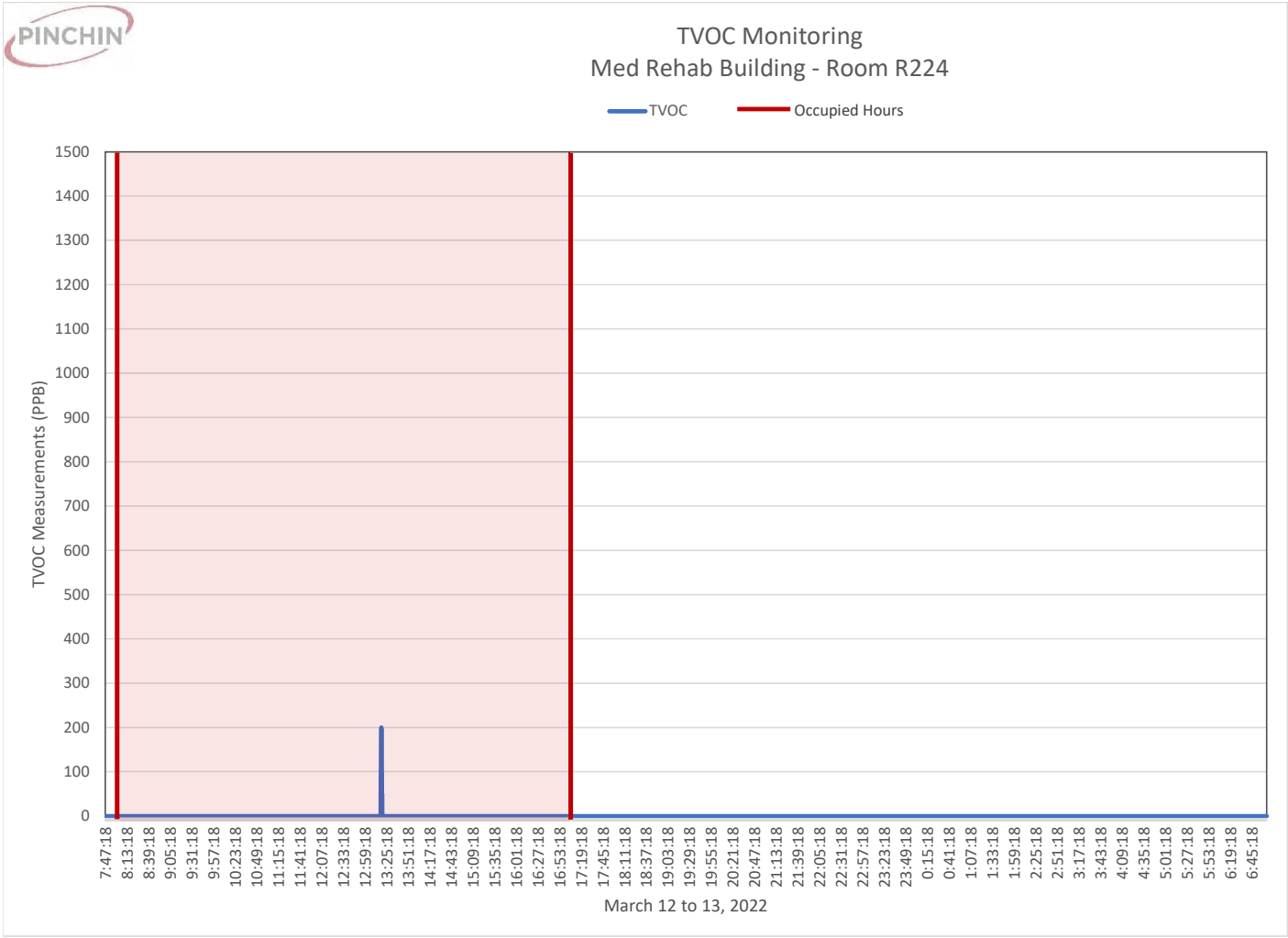
4:09:18
4:35:18
5:01:18
5:27:18
5:53:18
6:19:18
6:45:18
March 12 to 13, 2022


PINCHIN
Temperature Monitoring
Med Rehab Building - Room R224
Temperature
Occupied Hours
Temperature Measurements (°C)
50.00
47.50
45.00
42.50
40.00
37.50
35.00
32.50
30.00
27.50
25.00
22.50
20.00
17.50
15.00
12.50
10.00
7.50
5.00
2.50
0.00
7:47:18
8:13:18
8:39:18
9:05:18
9:31:18
9:57:18
10:23:18
10:49:18
11:15:18
11:41:18
12:07:18
12:33:18
12:59:18
13:25:18
13:51:18
14:17:18
14:43:18
15:09:18
15:35:18
16:01:18
16:27:18
16:53:18
17:19:18
17:45:18
18:11:18
18:37:18
19:03:18
19:29:18
19:55:18
20:21:18
20:47:18
21:13:18
21:39:18
22:05:18
22:31:18
22:57:18
23:23:18
23:49:18
0:15:18
0:41:18
1:07:18
1:33:18
1:59:18
2:25:18
2:51:18
3:17:18
3:43:18
4:09:18
4:35:18
5:01:18
5:27:18
5:53:18
6:19:18
6:45:18
March 12 to 13, 2022


PINCHIN
Relative Humidity Monitoring
Med Rehab Building - Room R224
%RH
Occupied Hours
Relative Humidty Measurements (%RH)
100.00
95.00
90.00
85.00
80.00
75.00
70.00
65.00
60.00
55.00
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
7:47:18
8:13:18
8:39:18
9:05:18
9:31:18
9:57:18
10:23:18
10:49:18
11:15:18
11:41:18
12:07:18
12:33:18
12:59:18
13:25:18
13:51:18
14:17:18
14:43:18
15:09:18
15:35:18
16:01:18
16:27:18
16:53:18
17:19:18
17:45:18
18:11:18
18:37:18
19:03:18
19:29:18
19:55:18
20:21:18
20:47:18
21:13:18
21:39:18
22:05:18
22:31:18
22:57:18
23:23:18
23:49:18
0:15:18
0:41:18
1:07:18
1:33:18
1:59:18
2:25:18
2:51:18
3:17:18
3:43:18
4:09:18
4:35:18
5:01:18
5:27:18
5:53:18
6:19:18
6:45:18
March 12 to 13, 2022


PINCHIN
Airborne Dust (PM 2.5) Monitoring
Med Rehab Building - Room R224
PM2.5
Occupied Hours
PM 2.5 Measurements (µg/m³)
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
7:47:18
8:13:18
8:39:18
9:05:18
9:31:18
9:57:18
10:23:18
10:49:18
11:15:18
11:41:18
12:07:18
12:33:18
12:59:18
13:25:18
13:51:18
14:17:18
14:43:18
15:09:18
15:35:18
16:01:18
16:27:18
16:53:18
17:19:18
17:45:18
18:11:18
18:37:18
19:03:18
19:29:18
19:55:18
20:21:18
20:47:18
21:13:18
21:39:18
22:05:18
22:31:18
22:57:18
23:23:18
23:49:18
0:15:18
0:41:18
1:07:18
1:33:18
1:59:18
2:25:18
2:51:18
3:17:18
3:43:18
4:09:18
4:35:18
5:01:18
5:27:18
5:53:18
6:19:18
6:45:18
March 12 to 13, 2022


PINCHIN
TVOC Monitoring
Med Rehab Building - Room R224
TVOC
Occupied Hours
TVOC Measurements (PPB)
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
7:47:18
8:13:18
8:39:18
9:05:18
9:31:18
9:57:18
10:23:18
10:49:18
11:15:18
11:41:18
12:07:18
12:33:18
12:59:18
13:25:18
13:51:18
14:17:18
14:43:18
15:09:18
15:35:18
16:01:18
16:27:18
16:53:18
17:19:18
17:45:18
18:11:18
18:37:18
19:03:18
19:29:18
19:55:18
20:21:18
20:47:18
21:13:18
21:39:18
22:05:18
22:31:18
22:57:18
23:23:18
23:49:18
0:15:18
0:41:18
1:07:18
1:33:18
1:59:18
2:25:18
2:51:18
3:17:18
3:43:18
4:09:18
4:35:18
5:01:18
5:27:18
5:53:18
6:19:18
6:45:18
March 12 to 13, 2022